



78-08  
STACKS - S.B.T.



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# Highway Safety Literature

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**SAE:** Society of Automotive Engineers, Dept. HSL, 400 Commonwealth Drive, Warrendale, Pa. 15096. Order by title and SAE report number.

**TRB:** Transportation Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

**Corporate author:** Inquiries should be addressed to the organization listed in the individual citation.

## **ABSTRACT CITATIONS**



NHTSA accession number ----- HS-013 124  
 Title of document ----- **MAXIMUM BRAKE PEDAL FORCES PRODUCED BY  
 MALE AND FEMALE DRIVERS**  
 Abstract ----- The object of this research was to obtain data concerning the  
 maximum amount of brake pedal force that automobile drivers  
 were able to sustain over a period of ten seconds. Subjects  
 were told to apply the brakes in the test car as they would in a  
 panic stop, and to exert as much force as possible on the  
 pedal over the entire ten second test period. A total of 84 sub-  
 jects were tested, including 42 males and 42 females. The  
 results indicated that there is a wide distribution of values  
 which characterizes the pedal force that the subjects were able  
 to generate. Male subjects produced generally higher forces  
 than did females. Over half the women tested were unable to  
 exert more than 150 lbs. of force with either foot alone, but  
 when both feet were applied to the pedal, force levels rose sig-  
 nificantly.  
 Personal author(s) ----- by C. R. VonBuseck  
 Corporate author (or author's affiliation) ----- General Motors Corp.  
 Publication date; pagination ----- 1973? ; 18p  
 Supplementary note ----- Excerpts from Maximum Parking Brake Forces Applied by  
 Male and Female Drivers (EM-23) BY R. L. Bierley, 1965, are  
 included.  
 Availability ----- Availability: Corporate author

NHTSA accession number ----- HS-018 924  
 Title of document ----- **NATURAL FREQUENCIES OF THE BIAS TIRE**  
 Abstract ----- The lowest natural frequencies of a bias tire under inflation  
 pressure are deduced by assuming the bias tire as a composite  
 structure of a bias-laminated, toroidal membrane shell and  
 rigorously taking three displacement components into con-  
 sideration. The point collocation method is used to solve a  
 derived system of differential equations with variable coeffi-  
 cients. It is found that the lowest natural frequencies calcu-  
 lated for two kinds of bias tire agree well with the correspond-  
 ing experimental results in a wide range of inflation pressures.  
 Results of the approximate analysis show that the influences  
 of the in-plane inertia forces on natural frequency may be con-  
 sidered small, but the influences of in-plane displacements are  
 large, particularly on the natural frequency of the tire under  
 low inflation pressure.  
 Personal author(s) ----- by Masami Hirano; Takashi Akasaka  
 Journal citation ----- Publ: Tire Science and Technology v4 n2 p86-114 (May 1976)  
 Publication date ----- 1976; 6refs  
 Availability ----- Availability: See publication

COMPUTER SIMULATION WAS UTILIZED TO SIMULTANEOUSLY ASSESS THE INFLUENCE OF CAR DESIGN PARAMETERS ON VEHICLE PERFORMANCE IN LIMIT MANEUVERS AND ON DRIVER PREFERENCE JUDGMENTS, AND TO EVALUATE THE POSSIBILITY OF OBTAINING CONFLICTING RESULTS WHEN VEHICLE DESIGN PARAMETERS ARE ALTERED TO IMPROVE OBJECTIVE AND/OR SUBJECTIVE HANDLING PERFORMANCE. THIS STUDY WAS CONDUCTED IN VIEW OF THE RECENT EMPHASIS IN GOVERNMENT SAFETY RESEARCH WHICH RAISES THE POSSIBILITY THAT FUTURE VEHICLES MAY BE REQUIRED TO PERFORM EVASIVE MANEUVERS AT HIGH LEVELS OF LONGITUDINAL AND LATERAL ACCELERATIONS. IF SO, AUTO MANUFACTURERS MAY BE FACED WITH THE DIFFICULT TASK OF DESIGNING VEHICLES TO MEET INDEPENDENT AND, AT TIMES, CONFLICTING HANDLING REQUIREMENTS. WHILE THE TRADITIONAL SUBJECTIVE NEEDS OF THE CUSTOMERS WOULD STILL HAVE TO BE ACCOMMODATED, OBJECTIVE PERFORMANCE REQUIREMENTS DEVELOPED FROM TESTS, SUCH AS THOSE SPONSORED BY THE NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION (NHTSA), WOULD ALSO AFFECT VEHICLE DESIGN. COMPUTER SIMULATION OF A STATION WAGON IN SEVERAL HANDLING TEST MANEUVERS (BRAKE-IN-A-TURN (BIT), CONTINUOUS DIRECTIONAL CONTROL, AND STEP-STEER PERFORMANCE EVALUATION) WAS THE BASIC METHOD OF THIS STUDY. THE SIMULATION WAS CARRIED OUT USING A DIGITAL VERSION OF THE NHTSA/APL COMPUTER MODEL. THE OUTPUT OF THE MODEL PROVIDED A BASIS FOR CALCULATING LIMIT OBJECTIVE PERFORMANCE AS WELL AS ESTIMATES OF TWO QUASISUBJECTIVE INDICATORS, ONE FOR SUBJECTIVE ACCEPTABILITY IN BIT-TYPE MANEUVERS AND THE OTHER BASED UPON DIRECTIONAL CONTROL CONSIDERATIONS. THIS PERFORMANCE WAS COMPARED FOR FOUR DIFFERENT DESIGN VARIATIONS INVOLVING FRONT ROLL-BAR STIFFNESS, KINGPIN OFFSET DISTANCE AND BRAKE TORQUE DISTRIBUTION. IT WAS FOUND THAT NONE OF THE VEHICLE CONFIGURATIONS EVALUATED WERE SUPERIOR IN ALL OF THE AREAS OF SUBJECTIVE AND OBJECTIVE VEHICLE PERFORMANCE. ALSO, THE FACT THAT THE IMPROVEMENT OF VEHICLE PERFORMANCE IN ONE MANEUVER COULD DEGRADE IT IN THE OTHERS SUGGESTS THAT FUTURE HANDLING AND BRAKING STANDARDS SHOULD NOT BE DRAWN ON A MANEUVER-BY-MANEUVER BASIS.

by S. L. CHIANG; D. S. STARR  
FORD MOTOR CO.  
Rept. No. SAE-780009; 1978; 10P 12REFS  
TECHNICAL PAPER SERIES. PRESENTED AT CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: SAE

CRASHWORTHINESS OBSERVATIONS MADE AS PART OF NATIONAL TRANSPORTATION SAFETY BOARD (NTSB) INVESTIGATIONS OF MAJOR RAILROAD ACCIDENTS FOR A PERIOD OF OVER TEN YEARS ARE REVIEWED AND SIGNIFICANT FACTORS AND RECOMMENDATIONS POINTED OUT. IT IS STATED THAT NTSB PERSPECTIVE ON RAILROAD CRASHWORTHINESS IS BASED HEAVILY ON GENERAL PRINCIPLES DEVELOPED IN HIGHWAY CRASH INJURY PREVENTION AND AVIATION CRASH SURVIVAL. STRUCTURAL CRASHWORTHINESS OF RAILROAD PASSENGER CARS, CRASH PROTECTION OF TRAIN CREWS, PROTECTION AGAINST RAILROAD CATASTROPHES, INJURY AND SURVIVAL IN RAIL RAPID TRANSIT, AND CRASH PROTECTION FOR VEHICLE OCCUPANTS AT GRADE CROSSINGS ARE SEPARATELY CONSIDERED. THE FOLLOWING CRASHWORTHINESS DESIGN NEEDS ARE PROPOSED, THOSE AREAS HAVING THE LARGEST NUMBER OF FATALITIES BEING LISTED FIRST: LOCOMOTIVE GRADE CROSSING CRASH ATTENUATORS, APPLICATION PLANS FOR GRADE CROSSING CRASH ATTENUATORS WHICH WOULD ENTAIL SHARED COSTS AND RESPONSIBILITY, MEANS OF PROTECTING RAILROAD PASSENGER CARS AGAINST DERAILMENT AT SPEEDS ABOVE 100 MPH WHERE COLLISION WITH ELECTRIC TOWER BASES IS POSSIBLE, MEANS OF PROTECTING RAILROAD PASSENGER CARS AGAINST DERAILED TRAINS CARRYING HAZARDOUS MATERIALS, PROTECTION OF MOTORMEN AND OCCUPANTS OF END SEATS OF TRANSIT CARS IN COLLISION, MEANS OF CONTROLLING INJURIES AMONG STANDING PASSENGERS IN TRANSIT CARS, DEFINITIVE CRASH PROTECTION FOR LOCOMOTIVE CREWS IN HEAD-ON COLLISIONS AND GRADE CROSSING ACCIDENTS INVOLVING HAZARDOUS MATERIALS, DEFINITIVE CRASH PROTECTION FOR CABOOSE OCCUPANTS, AND PROTECTION OF DINING CAR PASSENGERS AGAINST CRASHES AND KITCHEN CREWS AGAINST CRASH BURNS.

by HENRY H. WAKELAND  
NATIONAL TRANSPORTATION SAFETY BOARD  
Rept. No. SAE-780022; 1978; 12P  
TECHNICAL PAPER SERIES. PRESENTED AT CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: SAE

HS-022 515

## **IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMOTIVE FUEL ECONOMY AND EMISSIONS**

MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECTS IMPACTED ON FUEL ECONOMY AND EMISSIONS FOR THE FIVE PARTICIPATING AREAS (ALABAMA; ARIZONA; WASHINGTON, D.C.; PUERTO RICO; AND TENNESSEE) IN THE NHTSA

(NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION)-SUPPORTED PROGRAM. PROJECT DATA ON FUEL CONSUMPTION UNDER ACTUAL DAY-TO-DAY DRIVING CONDITIONS WHICH WERE COLLECTED FROM INDIVIDUAL MOTORISTS SHOWED A 4.7% IMPROVEMENT IN FUEL ECONOMY AFTER REPAIR TO CORRECT EMISSIONS. IF THIS COULD BE PROJECTED NATIONWIDE, IT WOULD MEAN SAVING ABOUT 1.8 BILLION GALLONS OF GASOLINE PER YEAR, AND A SUBSEQUENT SAVINGS OF \$1.1 BILLION PER YEAR FOR THE CONSUMER. IN A CONCURRENT STUDY WITH THE ENVIRONMENTAL PROTECTION AGENCY (EPA), SAMPLES OF COMPACT AND INTERMEDIATE CARS WERE TESTED FOR EMISSIONS AND FUEL ECONOMY. MINIMUM REPAIRS WERE MADE TO MEET INSPECTION CRITERIA, WITH AN AVERAGE REPAIR COST OF \$16. OF THESE CARS, 65% REQUIRED NO PARTS. THESE DATA INDICATE THAT PERIODIC DIAGNOSTIC EMISSION INSPECTION AND MAINTENANCE OF REJECTED CARS CAN BE ADMINISTERED AT LOW COST, REDUCE POLLUTION LEVELS OF HYDROCARBON (HC) AND CARBON MONOXIDE (CO), AND SIGNIFICANTLY IMPROVE FUEL ECONOMY. ANALYSIS OF THE EMISSIONS DATA SHOWS AN OVERALL AVERAGE REDUCTION OF 22% FOR HC AND 12% FOR CO. THE VEHICLE FAILURE RATE FOR EMISSIONS DECREASED FROM 23% TO 10% OVER A ONE-YEAR PERIOD.

by TED BAYLER; LESLIE EDER  
NATIONAL HWY. TRAFFIC SAFETY  
ADMINISTRATION, WASHINGTON, D.C. 20590  
Rept. No. SAE-780028; 1978; 12P 3REFS  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 516

### REPAIR INDUSTRY RESPONSE TO DIAGNOSTIC INSPECTION PROJECTS

THE MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECTS SPONSORED BY THE NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION (NHTSA) WERE CONDUCTED IN HUNTSVILLE, ALA.; PHOENIX AND TUCSON, ARIZ.; WASHINGTON, D.C.; BAYAMON, PONCE, AND SAN JUAN, P.R.; AND CHATTANOOGA, TENN. A TOTAL OF 92,819 PERIODIC INSPECTIONS AND 32,734 REINSPECTIONS (AFTER REPAIR) WERE PERFORMED. THE RELATIONSHIPS TO DIAGNOSTIC INFORMATION PROVIDED, DURATION OF PROJECT OPERATION, PROJECT LOCATION, AND TYPE OF FACILITY PERFORMING THE REPAIRS ARE ALSO DISCUSSED. VEHICLES RETURNED TO THE PROJECTS FOR REINSPECTION FAILED AT AN AVERAGE RATE OF 27.7%; SUBSYSTEMS WERE INADEQUATELY REPAIRED AT AN AVERAGE RATE OF 12.5%. EMISSION-RELATED REPAIRS WERE MOST LIKELY TO BE PERFORMED INCORRECTLY, FOLLOWED BY LIGHTING, ALIGNMENT, AND BRAKES; INSPECTION OF ALL OF THESE SUBSYSTEMS WAS PERFORMANCE-ORIENTED, AND REPAIR OFTEN REQUIRED COMPONENT ADJUSTMENT RATHER THAN REPLACEMENT. THE AUTOMOTIVE REPAIR INDUSTRY SERVING THOSE PROJECTS LOCATED IN JURISDICTIONS HAVING MANDATORY PMVI (PERIODIC

MOTOR VEHICLE INSPECTION) PERFORMED ADEQUATE REPAIRS AT A SIGNIFICANTLY HIGHER RATE THAN THOSE SERVING AREAS WITHOUT PMVI. ON THE AVERAGE, PROJECT PARTICIPANTS RECEIVED A HIGHER PROPORTION OF ADEQUATE REPAIRS WITH INCREASING TIME OF PROJECT OPERATION. IN GENERAL, THE GREATER THE DIFFERENCE IN CONTENT OF INSPECTION INFORMATION GIVEN THE PROJECT PARTICIPANTS, THE GREATER THE DIFFERENCE IN ADEQUACY OR COST OF THE REPAIR RECEIVED. THE RATIO OF NUMBERS OF SUBSYSTEMS REPAIRED TO NUMBER INITIALLY REJECTED WAS NEARER UNITY DURING THE SECOND INSPECTION CYCLE, SUGGESTING CLOSER ADHERENCE TO INSPECTION RESULTS WITH INCREASING TIME OF PROJECT OPERATION. THE AVERAGE COST OF VEHICLE REPAIR PERFORMED IN RESPONSE TO INITIAL INSPECTION FAILURE DECREASED FROM \$60.41 TO \$50.02 OVER THE DURATION OF THE PROJECTS (MID-MAR 1975 TO 30 JUN 1976); MOST OF THE COST REDUCTION RESULTED FROM THE REPAIR OF FEWER SUBSYSTEMS PER VEHICLE. SOME 49% OF ALL REPAIR DOLLARS WERE SPENT AT INDEPENDENT GARAGES, WITH NEW CAR DEALERS ACCOUNTING FOR AN ADDITIONAL 29%; THE VEHICLE OWNERS THEMSELVES WHOLLY OR PARTIALLY PERFORMED ABOUT 22% OF THE TOTAL REPAIRS. THE AVERAGE COST OF REPAIRS WAS HIGHEST AT THE CHAIN SPECIALTY AND GENERAL TYPES OF FACILITIES, BUT ADEQUATE REPAIRS WERE MORE FREQUENTLY RECEIVED AT THESE FACILITIES (VICE VERSA FOR REPAIRS PERFORMED BY THE VEHICLE OWNERS THEMSELVES). FINALLY, FOR SOME REPAIR FACILITIES THE DIAGNOSTIC CENTERS SERVED AS A LOCAL REFERENCE STANDARD FOR CALIBRATION OF INSPECTION EQUIPMENT, RESOLUTION OF VEHICLE PROBLEMS, AND INFORMAL MEDIATION OF CUSTOMER DISPUTES.

by WENDELL A. COOK  
NATIONAL HWY. TRAFFIC SAFETY  
ADMINISTRATION, WASHINGTON, D.C. 20590  
Rept. No. SAE-780030; 1978; 28P 19REFS  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 517

### HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY

A NATIONWIDE PROGRAM CONDUCTED OVER 14 MONTHS BY THE CHAMPION SPARK PLUG CO., THE MOBILE PROVING GROUND (MPG) PROJECT, TO GATHER DATA ON THE RELATIONSHIP BETWEEN PASSENGER CAR ENGINE CONDITION AND FUEL CONSUMPTION AND EMISSIONS IS DISCUSSED. SPECIFICALLY, THE TEST PROGRAM WAS INTENDED TO DETERMINE ON A NATIONWIDE BASIS HOW ENGINE CONDITION AND MAINTENANCE RELATE TO FUEL ECONOMY AND EMISSION REDUCTION; TO DEMONSTRATE TO THE CONSUMER THE ADVANTAGES OF A TUNE-UP IN REDUCING EMISSIONS AND CONSERVING FUELS; TO PROVIDE BETTER VEHICLE PERFORMANCE; AND TO FURNISH

GOVERNMENT AGENCIES WITH MORE REALISTIC DATA SO THAT LOGICAL RECOMMENDATIONS CAN BE MADE IN REGARD TO LIMITS, CONTROLS, AND INSPECTION PROGRAMS. THE TEST PROGRAM CONSISTED OF A DIAGNOSTIC CHECK LANE TO OBTAIN STATISTICAL INFORMATION FROM THE MOTORIST IN REGARD TO THE USAGE OF HIS/HER AUTOMOBILE AND TO DETERMINE THE CONDITION OF THE CAR'S ENGINE IN RELATION TO ITS OPERATING EFFICIENCY, AND A MOBILE CHASSIS DYNAMOMETER LABORATORY TO TEST SELECTED VEHICLES DURING SIMULATED ROAD LOAD CONDITIONS IN A "BEFORE" AND "AFTER" TUNE-UP CONDITION SO THAT A PERCENT OF IMPROVEMENT COULD BE RECORDED. OF THE 5666 CARS THAT COMPLETED THE DIAGNOSTIC CHECK, 44.6% WERE FOUND TO HAVE FAILED THE PHASE III NEW JERSEY EMISSION LIMITS (SCHEDULED TO HAVE BECOME EFFECTIVE 1 JAN 1977). THE 216 CARS TESTED ON THE DYNAMOMETER FOR FUEL ECONOMY IMPROVEMENT AND EMISSIONS BEFORE AND AFTER TUNE-UP, SHOWED AN AVERAGE FUEL ECONOMY IMPROVEMENT OF 11.36% AND AN EMISSION REDUCTION OF 45.37% FOR CARBON MONOXIDE (CO) AND 55.50% FOR HYDROCARBON (HC). NEW SPARK PLUGS ALONE, ON THE AVERAGE, IMPROVED FUEL CONSUMPTION BY 3.68% AND REDUCED HC EMISSIONS BY 24.33% AT IDLE. THE ONE OVERRIDING FACT THAT THIS SURVEY REVEALED WAS THE LACK OF VEHICLE MAINTENANCE BY THE MOTORING PUBLIC. OF ALL THE CARS SURVEYED, 79% NEEDED SOME MAINTENANCE WORK TO KEEP THE CAR AT AN OPTIMUM PERFORMANCE LEVEL. THE MAIN TWO CATEGORIES REQUIRING SERVICE TO RESTORE THE VEHICLE TO THE OPTIMUM LEVEL WERE IGNITION AND CARBURETION. THIS PROGRAM, INTENDED TO BE THE MOST COMPREHENSIVE LOOK AT MOTORIST MAINTENANCE HABITS AND THEIR EFFECTS ON FUEL CONSUMPTION/EMISSIONS EVER UNDERTAKEN BY A NONGOVERNMENTAL SOURCE, CLEARLY POINTED OUT THE ADVANTAGES GAINED BY NEW PLUGS ALONE OR COMPLETE ENGINE TUNE-UP IN PROVIDING BETTER MILEAGE, LOWER EMISSIONS, AND BETTER OVERALL DRIVING PERFORMANCE.

by D. L. WALKER; J. O. BOORD; J. S. PIGOTT; E. R. SUTTON  
CHAMPION SPARK PLUG CO.  
Rept. No. SAE-780032; 1978; 15P 4REFS  
TECHNICAL PAPER SERIES. PRESENTED AT CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: SAE

HS-022 518

### **ECONOMIC COMPARISON OF FUTURE AUTOMOTIVE POWER SYSTEMS**

AN APPROACH TO THE ECONOMIC EVALUATION OF ADVANCED AUTOMOTIVE POWER SYSTEMS IS PRESENTED. PROJECTED INITIAL COSTS AND OPERATING COSTS FOR A SUBCOMPACT CAR AND A FULL-SIZED CAR POWERED BY FOUR DIFFERENT ADVANCED POWER SYSTEMS (AN ADVANCED SPARK IGNITION ENGINE, A LIGHTWEIGHT DIESEL ENGINE, A BATTERY-POWERED ELECTRIC MOTOR, AND A

DIESEL ELECTRIC HYBRID SYSTEM) WERE DERIVED AND COMPARED. THE OPERATING ECONOMICS ARE BASED ON A DETAILED ANALYSIS OF THE POWER SYSTEM ENERGY CONSUMPTION. A PROPRIETARY (EXXON ENTERPRISES INC.) COMPUTER PROGRAM WAS USED TO SIMULATE VEHICLE OPERATION ON A SPECIFIC DRIVING CYCLE (EPA URBAN DRIVING CYCLE) AND THUS PROVIDE SUITABLE ENERGY CONSUMPTION ESTIMATES. THE INITIAL AND OPERATING COSTS OF THE VEHICLES ALSO REFLECT THE DIFFERENT SIZE AND WEIGHT OF THE POWER SYSTEMS, AS WELL AS WEIGHT PROPAGATION EFFECTS ON THE REST OF THE VEHICLE. FOR A MEANINGFUL COMPARISON BASIS, EACH VEHICLE POWER SYSTEM WAS SIZED TO ACHIEVE AN EQUIVALENT PERFORMANCE LEVEL (CARRYING CAPACITY, ACCELERATION CAPABILITY, ETC.), TO THE EXTENT POSSIBLE WITH MOTIVE COMPONENTS OF VASTLY DIFFERENT CHARACTERISTICS. THE ANALYSIS SHOWED THAT ADVANCED ELECTRIC HYBRID POWER SYSTEMS PROMISE SUBSTANTIAL FUEL SAVINGS AND LOW OPERATING COSTS. THEIR ATTRACTIVENESS IS PARTICULARLY APPARENT IN LARGER, MORE POWERFUL CARS, WHERE FUEL ECONOMY ADVANTAGES COULD HAVE A SIGNIFICANT IMPACT ON FLEET AVERAGE CONSUMPTION.

by G. MAURI; G. P. FETTERMAN, JR.; R. L. RICCI  
EXXON ENTERPRISES INC.  
Rept. No. SAE-780035; 1978; 8P 8REFS  
TECHNICAL PAPER SERIES. PRESENTED AT CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: SAE

HS-022 519

### **RELIABILITY, MAINTAINABILITY, SAFETY AND HUMAN FACTOR (RMSH) CONSIDERATIONS IN THE AUTOMOTIVE INDUSTRY**

A WORKABLE FORMAT IS PRESENTED TO INTEGRATE RELIABILITY, MAINTAINABILITY, SAFETY AND HUMAN FACTOR (RMSH) CONSIDERATIONS AND THE CONVENTIONAL DESIGN ENGINEERING PROCESS IN THE AUTOMOTIVE INDUSTRY TO SATISFY CUSTOMER EXPECTATIONS AND TO MEET GOVERNMENT STANDARDS. THE GOVERNMENT EMPHASIS APPEARS TO BE MORE ON SAFETY AND ENVIRONMENTAL PROTECTION; WHEREAS THE CONSUMER EMPHASIS IS ON THE RELIABILITY, MAINTAINABILITY, AND HUMAN FACTORS ASPECT OF THE PRODUCT. TO TRANSLATE THESE GOVERNMENT AND CONSUMER REQUIREMENTS TO DESIGN PARAMETERS HAS BEEN A CONSTANT CHALLENGE TO THE DESIGN ENGINEER IN THE AUTOMOTIVE INDUSTRY. THE FOLLOWING FIVE ESSENTIAL ELEMENTS WHICH ARE REQUIRED TO INTEGRATE THE RMSH CONSIDERATIONS IN THE DESIGN ARE DISCUSSED: DEFINITION OF RMSH CONSIDERATIONS IN THE AUTOMOTIVE INDUSTRY, THE POINTS IN A DESIGN CYCLE IN WHICH THE RMSH CONSIDERATIONS SHOULD ENTER, THE POINTS AT WHICH RMSH CONSIDERATIONS SHOULD BE REVIEWED, THE PERSONS DIRECTLY RESPONSIBLE FOR THE RMSH DESIGN PARAMETERS, AND THE EFFECTIVE MECHANISMS BY WHICH THE MANAGEMENT CAN

PARTICIPATE IN THE RMSH DESIGN TRADE-OFFS. A FOUR-STEP APPROACH TO REMOVE THE EXISTING INADEQUACY OF THE CONVENTIONAL DESIGN ENGINEERING PROCESS IN THE AUTOMOTIVE INDUSTRY IS RECOMMENDED. FIRST, THE RELIABILITY ENGINEER MUST BE GIVEN ASSIST/CONTROL AUTHORITY. THE DESIGN ENGINEER STILL HAS THE DIRECT RESPONSIBILITY FOR THE DESIGN. MANAGEMENT CAN OVERRIDE THE RELIABILITY ENGINEER'S CONTROL BY TAKING A KNOWN RISK. SECOND, CHECK LISTS MUST BE DEVELOPED FOR EACH DESIGN REVIEW SO THAT THE APPROPRIATE RMSH ACTIVITIES CAN BE PERFORMED AND REVIEWED AT EACH PRODUCT DEVELOPMENT STAGE. THIRD, THE RMSH PARAMETERS MUST BE DEFINED AT THE PRODUCT PLANNING STAGE. AND, FOURTH, AVAILABILITY IS THE DESIRABLE PARAMETER IN THE AUTOMOTIVE INDUSTRY. IT PUTS A STRONG EMPHASIS ON PRODUCT RELIABILITY AND PRODUCT MAINTAINABILITY. THEREFORE, AVAILABILITY MUST BECOME A CONTROLLING DESIGN PARAMETER.

by H. J. BAJARIA  
ROCKWELL INTERNATIONAL  
Rept. No. SAE-780053; 1978; 10P 2REFS  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 520

#### **A DATA RECORDING SYSTEM OF THE PATH OF A TEST VEHICLE BY LASER BEAM AND SOME APPLICATIONS TO STEERING HANDLING TEST**

EQUIPMENT DEVELOPED TO AUTOMATICALLY MEASURE THE POSITION OR PATH OF AN AUTOMOBILE BY TRIANGULATION USING LASER BEAMS, AND TO PROCESS THE DATA USING A COMPUTER, CONSISTS OF A MECHANICAL SECTION INCLUDING OPTICAL DEVICES AND MOTORS, AN ELECTRONIC SECTION, AND A DATA-COLLECTION SECTION, ALL FORMED INTO A SINGLE UNIT. RESULTS OF SOME STEERING-HANDLING TESTS IN WHICH THE EQUIPMENT WAS APPLIED ARE PRESENTED.

by HIDEO SAKAI  
JAPAN AUTOMOBILE RES. INST., INC.  
Rept. No. SAE-780063; 1978; 16P 4REFS  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 521

#### **THE NASA [NATIONAL AERONAUTICS AND SPACE ADMINISTRATION] NASTRAN STRUCTURAL ANALYSIS COMPUTER PROGRAM--NEW CONTENT**

THE NASA (NATIONAL AERONAUTICS AND SPACE ADMINISTRATION)-DEVELOPED STRUCTURAL ANALYSIS COMPUTER PROGRAM CALLED NASTRAN IS IN EXTENSIVE USE IN THE AUTOMOTIVE INDUSTRY AS WELL AS IN THE AEROSPACE AND HELICOPTER IN-

DUSTRIES, AND HAS BECOME A STANDARD OF REFERENCE AMONG FINITE-ELEMENT PROGRAMS. IN ADDITION TO ITS PRIMARY ADVANTAGES: PUBLIC PROGRAM (AVAILABLE THROUGH COSMIC); EXTENSIVE DOCUMENTATION; ABILITY TO RUN ON IBM, CDC, AND UNIVAC EQUIPMENT; AND VIGOROUS MAINTENANCE AND EXPANSION, THE NASTRAN PROGRAM HAS EXPANDED AND GROWN OVER THE PAST EIGHT YEARS UNTIL IT NOW CONTAINS A WIDE RANGE OF USER-ORIENTED STRUCTURAL ANALYSIS AND DESIGN SOFTWARE. THE EVOLUTION OF THE PROGRAM'S CAPABILITIES FOR THIS PERIOD OF TIME IS SHOWN IN TABLES WHICH OUTLINE ENGINEERING CAPABILITIES, OTHER PROVISIONS AND SIZE OF ITS VARIOUS LEVELS (VERSIONS) FROM SEP 1970 TO DEC 1977. THE CAPABILITIES CURRENTLY AVAILABLE IN THE PROGRAM AS DISTRIBUTED BY COSMIC ARE DESCRIBED. SOME DEFINITION OF MAINTENANCE ACTIVITIES AND SOME CURRENT INFORMATION ON USE ARE ALSO INCLUDED.

by DEENE J. WEIDMAN  
NATIONAL AERONAUTICS AND SPACE  
ADMINISTRATION, LANGLEY RES. CENTER  
Rept. No. SAE-780074; 1978; 7P  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 522

#### **OVERVIEW OF ELECTRIC VEHICLES IN THE UNITED STATES**

THE DEPT. OF ENERGY'S ELECTRIC AND HYBRID VEHICLE PROG. IS THREEFOLD IN PURPOSE AS FOLLOWS: TO ENCOURAGE THE NECESSARY ELECTRIC AND HYBRID VEHICLE TECHNOLOGY ADVANCEMENT THAT WILL LEAD TO IMPROVEMENT IN THE PERFORMANCE OF ELECTRIC VEHICLES ON THE HIGHWAY; TO ASSESS THE ECONOMIC AND TECHNICAL PRACTICABILITY OF ELECTRICS BY UNDERTAKING A BROADLY-BASED, FEDERALLY-SUPPORTED, VEHICLE DEMONSTRATION OF UP TO 10,000 VEHICLES BEGINNING IN 1978; AND TO ENHANCE THE VIABILITY OF THE INFANT ELECTRIC AND HYBRID VEHICLE INDUSTRY BY ASSISTING IT IN FINANCING THE COMMERCIAL PRODUCTION OF COMPETITIVE VEHICLES. CURRENT STATUS IS OUTLINED AS OF FEBRUARY 1978 FOR THE DEMONSTRATION AND TECHNOLOGY DEVELOPMENT EFFORTS, INCLUDING BOTH VEHICLE AND BATTERY DEVELOPMENTS. PERFORMANCE SPECIFICATIONS ARE NOTED FOR THE FIRST 200-400 VEHICLE DEMONSTRATION IN 1978 AND FOR THE NEAR-TERM DEPARTMENT OF ENERGY INTEGRATED ELECTRIC VEHICLE DEVELOPMENT. ALTHOUGH COMPETITIVE SUCCESS OF ELECTRIC AND HYBRID VEHICLES IS QUESTIONABLE FOR THE NEXT DECADE, EVENTUAL COMMERCIAL ACCEPTANCE OF SUCH VEHICLES AS A MAJOR PETROLEUM CONSERVATION TOOL IS PREDICTED. BY THE END OF THIS CENTURY, 10-15 MILLION

August 31, 1978

HS-022 525

ELECTRIC OR HYBRID VEHICLES COULD BE SAVING 100-150 MILLION BARRELS OF OIL A YEAR.

by VINCENT J. ESPOSITO  
DEPARTMENT OF ENERGY  
Rept. No. SAE-780085; 1978; 7P  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 523

### CONSUMER ACCEPTANCE OF DOWN-SIZED AUTOMOBILES

THE IMPLICATIONS OF DOWN-SIZING AUTOMOBILES WITH RESPECT TO THE MARKETPLACE ARE DISCUSSED, INCLUDING THE SCOPE OF THE MARKET SERVED, THE BEHAVIOR OF CONSUMERS IN THE MARKETPLACE, AND THE MARKETING STRATEGIES EMPLOYED BY FIRMS TO POSITION EXISTING PRODUCTS AND TO INTRODUCE NEW PRODUCTS. CONSUMER BEHAVIOR THEORY SUGGESTS THAT SO LONG AS DEMAND IS DIFFERENTIATED IN THE MARKETPLACE, MANUFACTURERS WILL ATTEMPT TO MEET THAT DEMAND, SUBJECT TO OPERATING CONSTRAINTS. HOWEVER, TO THE EXTENT THAT REDUCTIONS IN THE RANGE OF SIZES AVAILABLE IN THE MARKETPLACE ALSO REDUCE THE DISTINCTIONS AMONG ALTERNATIVE VEHICLES, THE PROBABILITY OF SELECTING ANY GIVEN VEHICLE APPROACHES PURE CHANCE. THE TRADITIONAL LINES OF DEMARCATION BETWEEN SMALL AND INTERMEDIATE CARS AND BETWEEN INTERMEDIATE AND STANDARD-SIZED CARS VISIBLE AS LATE AS 1976 BEGIN TO DISAPPEAR IN 1977 WITH THE INTRODUCTION OF DOWN-SIZED STANDARD CARS. THE OVERLAP BETWEEN INTERMEDIATE AND STANDARD CAR LENGTHS CONFOUNDED THE HISTORICAL DIRECT RELATIONSHIP AMONG SIZE, PRICE, AND STANDARD EQUIPMENT USED BY BUYERS IN EVALUATING ALTERNATIVE VEHICLES AVAILABLE IN THE MARKETPLACE. THE FACT THAT IN THE FIRST NINE MONTHS OF 1977, STANDARD CAR SALES EXCEEDED SALES OF INTERMEDIATE VEHICLES IS SOME INDICATION THAT BUYERS PERCEIVED THE FULLY EQUIPPED, DOWN-SIZED STANDARD CARS TO BE OF GREATER VALUE THAN INTERMEDIATE CARS OF SIMILAR LENGTH. THE INTRODUCTION OF DOWN-SIZED INTERMEDIATES IN THE 1978 MODEL YEAR ERASED THE HISTORICAL SIZE CLASSES. THE CONSUMER MUST NOW EVALUATE ALTERNATIVE VEHICLES ALONG A CONTINUUM OF SIZE WHICH RELATES POORLY TO THE VALUE OF THE PRODUCTS OFFERED. IN THE SHORT TERM, DOMESTIC MANUFACTURERS MUST SECURE THEIR POSITION IN THE MARKETPLACE BY AGGRESSIVELY CHALLENGING THE IMPORT SHARE OF THE SMALL-CAR MARKET. IN THE LONG TERM, THE ECONOMIC VIABILITY OF DOMESTIC MANUFACTURERS MUST RELY HEAVILY ON ENGINEERING AND DESIGN TO RE-ESTABLISH TRADITIONAL SIZE CLASSES AT

LOWER LEVELS AND, ULTIMATELY, TO RESTORE A RANGE OF CHOICE TO THE CONSUMER.

by PATRICIA L. BRADEN  
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BUSINESS ADMINISTRATION  
Rept. No. SAE-780090; 1978; 14P 11REFS  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 524

### MOTOR VEHICLE TRAFFIC ACCIDENTS 1976

STATISTICAL TABLES ARE PRESENTED FOR MOTOR VEHICLE TRAFFIC ACCIDENTS WHICH OCCURRED IN THE STATE OF TEXAS DURING 1976. THE TABLES ARE DIVIDED INTO THE FOLLOWING SECTIONS: DEATHS AND CASUALTIES, WHERE ACCIDENTS HAPPEN, HOW ACCIDENTS HAPPEN, DRIVERS, AND VEHICLES. IN SUMMARY, THE FINAL COUNT OF 3230 MOTOR VEHICLE TRAFFIC DEATHS IN TEXAS FOR 1976 WAS A DECREASE OF 199 OR 6% FROM THE 3429 DEATHS IN 1975. DEATHS IN RURAL AREAS DECREASED BY 183 WHILE DEATHS IN CITIES OF 5000 OR MORE POPULATION DECREASED BY 16. THIS DECREASE IN TEXAS DEATHS OCCURRED DESPITE STATEWIDE INCREASES OF 8% IN VEHICLE MILES TRAVELED, 2% IN TOTAL ACCIDENTS REPORTED, AND 5% IN REPORTED INJURIES. THE DECREASE IN TEXAS DEATHS WAS ALSO COUNTER TO THE NATIONWIDE INCREASE OF 2% IN TRAFFIC DEATHS. THE 3.5 PERSONS KILLED FOR EACH ONE HUNDRED MILLION VEHICLE MILES TRAVELED ESTABLISHED THE LOWEST MOTOR VEHICLE TRAFFIC DEATH RATE RECORDED IN TEXAS SINCE TRAFFIC RECORDS HAVE BEEN MAINTAINED. DEATH TOOK ONLY ONE HOLIDAY (MONDAY, 18 OCT 1976). HOWEVER, THE NUMBER OF DAYS WITH 20 OR MORE TRAFFIC DEATHS DROPPED FROM 15 IN 1975 TO 8 IN 1976; 24 MAY AND 3 JUL, WITH 24 DEATHS EACH, WERE THE DEADLIEST DAYS IN TEXAS TRAFFIC FOR 1976. BASED ON REPORTED ACCIDENTS IN 1976, ONE PERSON WAS KILLED EVERY 2 3/4 HOURS, ONE PERSON WAS INJURED EVERY 3 3/4 MINUTES, ONE ACCIDENT OCCURRED EVERY 66 SECONDS, AND EVERY FIFTH ACCIDENT RESULTED IN DEATH OR INJURY.

TEXAS DEPT. OF PUBLIC SAFETY  
1977?; 48P 1REF  
Availability: CORPORATE AUTHOR

HS-022 525

### ACCIDENT RATES VS SHOULDER WIDTHS. FINAL REPORT

ACCIDENT RATES WERE COMPARED FOR ROADS IN THE CALIFORNIA STATE HIGHWAY SYSTEM BEFORE AND AFTER SHOULDERS WERE VARIABLY WIDENED OR ROADS WERE WIDENED FOR PASSING LANES. AN EVALUATION WAS MADE OF 37 SHOULDER WIDENING PROJECTS REPRESENTING 143 MILES (230 KM) OF IMPROVED ROAD. THE WIDENING PROJECTS WERE ESSENTIALLY COMPLETED ON THE EXISTING

LECTED FOR TWO-LANE ROADS WIDENED TO 28 FT (8.5 M), 32 FT (9.8 M), AND 40 FT (12.2 M) WHOSE RESPECTIVE SHOULDER WIDTHS ARE 2 FT (0.6 M), 4 FT (1.2 M), AND 8 FT (2.4 M). ACCIDENT RATES WERE REDUCED FOR ALL THREE SHOULDER-WIDENING WIDTHS. RATES WERE REDUCED 16% FOR 28-FT ROADS WITH UNDER 3000 AADT (ANNUAL AVERAGE DAILY TRAFFIC), 35% FOR 32-FT ROADS WITH UNDER 5000 AADT, AND 29% FOR 40-FT ROADS WITH OVER 5000 AADT. ACCIDENT RATE REDUCTIONS WERE STATISTICALLY SIGNIFICANT FOR 32-FT AND 40-FT ROADS AT THE 95% CONFIDENCE LEVEL. ANALYSIS OF THE DATA INDICATES THAT IF THE EXISTING ROAD IS 24 FT WIDE, WIDENING TO 28 FT (8.5 M) WILL NOT REDUCE ACCIDENTS. IN THE PASSING LANE STUDY, 23 PROJECTS WITH 51 MILES (82 KM) OF ROAD WERE STUDIED. WIDENING TWO-LANE ROADS TO THREE LANES WITH THE CENTER LANE FOR PASSING RESULTED IN THE FOLLOWING ACCIDENT RATE REDUCTIONS: 11% FOR 36-FT (11.0-M) ROADS, 25% FOR 40-FT (12.2-M) ROADS, AND 27% FOR 42-44-FT (12.8-13.9-M) ROADS. THE ACCIDENT RATE REDUCTIONS WERE SIGNIFICANT FOR THE 40-FT AND 42-44-FT ROADS. ANALYSIS OF THE DATA INDICATES THAT A 36-FT ROAD WITH A PASSING LANE IS ONLY APPROPRIATE FOR THOSE FEW ROADS WHERE THE EXISTING ROAD HAS STEEP GRADES, SHARP HORIZONTAL CURVATURE ALIGNMENT, AND WHERE THE COST OF A WIDER WIDTH WOULD BE PROHIBITIVE. AS PART OF THE PASSING LANE STUDY, ACCIDENT REPORTS WERE REVIEWED IN DEPTH FOR TWO ROUTES WITH PASSING LANES IN ORDER TO EVALUATE THE STRIPING USED TO DESIGNATE PERMISSIBILITY OF PASSING ON THREE-LANE ROADS (ONE-WAY BARRIER STRIPE VS. TWO-WAY BARRIER STRIPE). IT WAS CONCLUDED THAT THE ONE-WAY BARRIER STRIPE (SINGLE LANE PERMITTED TO PASS) MAY CAUSE PROBLEMS IN THAT IT MAY CREATE A FALSE SENSE OF SECURITY FOR DRIVERS. DRIVERS APPEAR TO MOVE INTO THE CENTER PASSING LANE WITHOUT LOOKING. IT IS FELT THAT THE ONE-WAY BARRIER STRIPE SHOULD BE USED WITH EXTREME CARE TO PREVENT THE OLD THREE-LANE HIGHWAY SITUATION OF SEVERE HEAD-ON COLLISIONS.

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Rept. No. CA-DOT-TR-3147-1-77-01; 1977; 65P 8REFS  
PREPARED IN COOPERATION WITH THE FEDERAL HWY. ADMINISTRATION.  
Availability: NTIS

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## THE SOCIALLY RESPONSIBLE CAR

RESEARCH PROGRAMS BEING CARRIED OUT BY CALSPAN CORP. AND MINICARS, INC. TO DEVELOP RESEARCH SAFETY VEHICLES (RSV'S) UNDER THE SPONSORSHIP OF THE NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION (NHTSA) ARE DESCRIBED. THE FOUR-PHASED NHTSA PROGRAM BEGAN IN JAN

OF THE PROGRAM INCLUDED ESTABLISHMENT OF INITIAL RSV SPECIFICATIONS; PHASE 2, WHICH BEGAN IN JUL 1975, INVOLVED DESIGN AND FINALIZATION OF RSV SPECIFICATIONS AS WELL AS TESTING OF PROTOTYPE CARS; PHASE 3 CALLS FOR DESIGN OPTIMIZATION; PHASE 4 WILL INVOLVE TESTING AND EVALUATING THE VEHICLES, DATA FROM WHICH WILL HELP TO FORMULATE FEDERAL STANDARDS. BOTH RESEARCH FIRMS ARE SCHEDULED TO DELIVER ACTUAL TEST CARS BY APR 1978. CALSPAN HAS DESIGNED A FIVE-PASSENGER RSV WITH THE IDEA OF PRODUCING A CAR THAT COULD BE MANUFACTURED RIGHT NOW. THE BASE VEHICLE IS A CHRYSLER SIMCA 1308, A FOUR-CYLINDER SUBCOMPACT THAT WAS "SAFETY CAR OF THE YEAR" IN EUROPE IN 1976. THE CALSPAN RSV WEIGHS UNDER 2700 POUNDS, GETS OVER 25 MILES TO THE GALLON, AND HAS A BODY STRUCTURED TO PROTECT OCCUPANTS IN FRONTAL BARRIER CRASHES AT SPEEDS UP TO 50 MPH, 45 MPH ON THE SIDE, AND 50 MPH IN THE REAR. IT HAS A "SOFT" FRONT END AND SOFT BUMPERS FOR PEDESTRIAN PROTECTION AND LOW DAMAGEABILITY. ITS INTERIOR TRIM PANELS ABSORB SOME OF THE ENERGY GENERATED BY A CRASH. IT ALSO HAS AN "INFLATABELT" PASSENGER RESTRAINT SYSTEM, A SHOULDER HARNESS MADE OF SOFT TUBING THAT INFLATES UPON IMPACT. THE BELT SYSTEM AUTOMATICALLY GOES INTO PLACE WHEN THE CAR DOORS ARE CLOSED. THE CAR ALSO HAS TIRES THAT RUN FLAT FOR 50 MILES AT 50 MPH. MINICARS HAS DESIGNED A MORE FUTURISTIC CAR. THE FOUR-PASSENGER MINICARS EAGLE II WEIGHS ABOUT 2200 POUNDS BUT PROVIDES THE SAME AMOUNT OF PASSENGER PROTECTION. A NOSE SECTION SUPPORTING THE FRONT BUMPER PREVENTS DAMAGE IN IMPACTS BELOW 10 MPH. AT THE SAME TIME, THE LIGHTWEIGHT STRUCTURE MINIMIZES FUEL COSTS. RESILIENT PLASTIC MATERIAL COVERS THE ENERGY-ABSORBENT STRUCTURE, WHICH IS DESIGNED TO CRUSH INITIALLY AT LOW FORCE LEVELS IN FRONTAL IMPACTS WITH THE VULNERABLE SIDES OF OTHER CARS. SIDE IMPACT AND ROLLOVER PROTECTION IS AFFORDED BY WELL-PADDED DOOR INTERIORS, REINFORCED DOOR CONSTRUCTION AND STRONGER DOOR LATCHES. OTHER UNCONVENTIONAL FEATURES OF THE VEHICLE ARE "FULL-WING" DOORS WHICH OPEN FROM THE TOP AND SWING OUTWARD AND UPWARD, AND A DASHBOARD WITH A BUILT-IN ELECTRONIC RADAR MICROCOMPUTER PROVIDING A HIGHLY ADVANCED DRIVER WARNING SYSTEM. ANOTHER RSV DEVELOPED BY VOLKSWAGEN, THE EXPERIMENTAL VW RABBIT, WAS PRESENTED TO THE DEPT. OF TRANSPORTATION IN JUL 1977.

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**THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977**

A COLLECTION OF 19 ARTICLES ON PUBLIC SERVICE VEHICLES (PSV) IN THE UNITED KINGDOM CONCERNS RESEARCH AND DEVELOPMENT ASPECTS OF PSV DESIGN, CONSTRUCTION, AND OPERATION. MOST ARTICLES CONCERN ISSUES OF ALTERNATIVES WHICH WILL INCREASE ECONOMY, SAFETY, AND POLLUTION CONTROL. PSV TRANSPORT FACES AN UNCERTAIN FUTURE IN THE UNITED KINGDOM DUE TO RISING COSTS AND INCREASING SHORTAGES OF OIL, AND INCREASING DIVERSIFICATION OF LIVING AND WORKING LOCATIONS. AN INVESTIGATION WAS CARRIED OUT OF METHODS OF ASSISTING EGRESS FROM THE EMERGENCY WINDOW OF A CLASS III TOURING COACH BY MEANS OF HANDHOLDS AND FOOTHOLDS. A REVIEW IS MADE OF ENVIRONMENTAL FACTORS WHICH ARE INCREASINGLY RELEVANT TO PSV OPERATION AND THE CHALLENGES TO VEHICLE DESIGNERS TO PROVIDE EFFECTIVE, RELIABLE, AND DURABLE SOLUTIONS WITHIN REALISTIC COST AND WEIGHT LIMITS. PSV TECHNICAL ENFORCEMENT ACTIVITIES ARE REVIEWED AND COMPARED WITH INFORMATION ON SIMILAR ACTIVITIES IN OTHER COUNTRIES. THE HISTORY OF HEATING, VENTILATING, AND DEMISTING ON PSV'S IS CHARACTERIZED BY DEVELOPMENT OF INCREASINGLY SOPHISTICATED SYSTEM DESIGN REQUIREMENTS LEADING TO IMPROVED ATMOSPHERIC CONDITIONS. AIR SPRINGS, USED IN VEHICLE SUSPENSIONS SINCE THE EARLY 20TH CENTURY, ARE COMPRISED OF THE CARCASS, BEAD RING, AND RUBBER SURFACE COVERINGS WHICH MAKE UP THE FLEXIBLE BELLOW OR DIAPHRAGM COMPONENT. AN ACTIVE RIDE CONTROL SYSTEM HAS BEEN DEVELOPED USING HYDRAULIC STRUTS AND GAS SPRING IN PLACE OF THE CONVENTIONAL COIL OR LEAF SPRING. RESEARCH HAS BEEN COMPLETED ON THE ROLLOVER PROBLEM OF SINGLE DECK PSV'S. CATEGORIES OF BUS AND COACH SERVICES ARE DESCRIBED IN TERMS OF COMPARATIVE PROPORTIONS OF EACH TYPE OF SERVICE TO THE TOTAL OPERATION. VARIOUS PROBLEMS, PARTICULARLY EXCESSIVELY HIGH TEMPERATURE EXIST IN DESIGNING AND OPERATING PSV BRAKES AND SYSTEMS. THE DETROIT DIESEL ALLISON RANGE OF AUTOMATIC TRANSMISSIONS HAS BEEN APPLIED TO PSV'S. COMPARATIVE COMPUTATIONAL INVESTIGATIONS OF VARIOUS BUS DESIGNS HAVE BEEN CARRIED OUT USING THE FINITE ELEMENT METHOD. RESEARCH AND TESTING IN THE FIELD OF PASSIVE SAFETY OF BUSES AND LIFE PREDICTION OF BUS STRUCTURES IS REPORTED. MATERIALS FOR BODY AND CHASSIS EXTERIOR USE ARE EXAMINED IN TERMS OF CHOICES AVAILABLE, DURABILITY, WEIGHT SAVING, FIRE RETARDANCE, AND NOISE ABSORPTION. REVIEW IS MADE OF THE CURRENT PERFORMANCE OF POWER UNITS AND TRANSMISSIONS AND THEIR DEVELOPMENT OVER THE LAST TWO DECADES. STA-

BILITY TESTS OF THIN-WALLED TUBES HAVE BEEN MADE UNDER DYNAMIC AXIAL LOADS. A NATIONAL PSV SURVEY HAS BEEN ESTABLISHED TO RECORD AND RETRIEVE DATA ON SERIOUS BUS ACCIDENTS. ALTERNATIVES IN PSV POWER TRAINS ARE REVIEWED BASED ON MAJOR REQUIREMENTS FORESEEN FOR THE 1980'S. A DYNAMIC TEST TO EVALUATE OCCUPANT RETENTION BY COACH SEATS IN SEVERE FRONTAL IMPACTS IS REPORTED.

INSTITUTION OF MECHANICAL ENGINEERS,  
LONDON, ENGLAND  
Rept. No. I-MECH-E-CONFERENCE-PUBLICATIONS-  
1977-6; 1977; 171P REFS  
INCLUDES HS-022 528--HS-022 546.  
Availability: CORPORATE AUTHOR

HS-022 528

**PROSPECTS FOR BUS AND COACH TRANSPORT [UNITED KINGDOM]**

BUS AND COACH TRANSPORT FACES AN UNCERTAIN FUTURE IN ENGLAND DUE TO RISING COSTS AND INCREASING SHORTAGES OF OIL, AND INCREASING DIVERSIFICATION OF LIVING AND WORKING LOCATIONS. TRANSPORT BY PRIVATE PASSENGER VEHICLE WILL PROBABLY IN THE NEAR FUTURE BE SHARED BECAUSE OF FUEL AVAILABILITY AND COST. THIS COULD BE FOLLOWED BY A REORIENTATION OF LIVING, WORKING, AND SHOPPING LOCATIONS AROUND MORE CENTRALIZED LOCATIONS. THE ENERGY-SAVING POTENTIAL OF PUBLIC TRANSPORTATION IS CURRENTLY NOT WELL UTILIZED BECAUSE OF THE DEGREE OF DIVERSIFICATION OF LIVING, WORKING, AND SHOPPING DESTINATIONS. LAND-USE PLANNING TO DELIBERATELY ACHIEVE REQUIRED TRANSPORTATION CHANGES IS RECOMMENDED IN ADVANCE OF FULL DEVELOPMENT OF ECONOMIC FORCES PROMOTING RECONCENTRATION. DESIGN AND PRODUCTION OF FULLY OPERATIONAL AND EFFICIENT BUSES WILL PROBABLY TAKE TEN YEARS; HOWEVER THE GROWTH TREND OF CAR OWNERSHIP IS NOT YET AT ITS PEAK, IMPLYING FURTHER DECREASES IN BUS SERVICE. THE MANUFACTURE OF SMALLER, MORE ENERGY-EFFICIENT BUSES MAY WELL BE A REASONABLE SHORT-TERM MEASURE. THE MANUFACTURE OF COACHES IS IMPORTANT TO THE SUPPLYING INDUSTRY IN GREAT BRITAIN, AND THEIR USE HAS TENDED TO INCREASE ALONG WITH A DECLINE IN DEMAND FOR NEW BUSES. WHILE FLEETS OF BUSES AND COACHES REQUIRED FOR PUBLIC TRANSPORT ARE EXPECTED TO DECLINE, THE FUTURE WILL PROVIDE A MARKET FOR BUSES TO OPERATE TOWN SERVICES, WHILE INTERURBAN AND COUNTY SERVICES WILL BEST BE SERVED BY COACHES WHICH FEATURE COMFORT AND THE CAPACITY TO CARRY LUGGAGE AND PARCELS.

by D. W. GLASSBOROW  
NATIONAL BUS CO., 25 NEW ST. SQUARE, LONDON,  
ENGLAND  
Publ: HS-022 527, (I-MECH-E-CONFERENCE-  
PUBLICATIONS-1977-6), "THE DESIGN,



CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P1-4  
Rept. No. C130/77; 1977  
PRESENTED AT A CONFERENCE SPONSORED BY INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977.  
Availability: IN HS-022 527

HS-022 529

**A DESIGN AND EVALUATION STUDY OF HANDHOLDS AND FOOTHOLDS FOR EMERGENCY WINDOWS OF CLASS III PUBLIC SERVICE VEHICLES [BUSES]**

AN INVESTIGATION WAS CARRIED OUT OF METHODS OF ASSISTING EGRESS FROM THE EMERGENCY WINDOW OF A CLASS III TOURING COACH (BUS) BY THE INTRODUCTION OF SUITABLY DESIGNED AND POSITIONED HANDHOLDS AND FOOTHOLDS. EXPERIMENTS WERE MADE ON A SPECIALLY DESIGNED FULL SIZE RIG WITH INTERCHANGEABLE HANDHOLDS AND FOOTHOLDS. THE IDEAL SOLUTION WAS THOUGHT TO BE A LADDER WITH ADEQUATE HANDRAILS AND TREADS AT THE TOP OF WHICH IS A PLATFORM OF OPTIMUM WIDTH. EXPERIMENTAL DESIGNS WERE BOTH PROJECTING AND RECESSED. THREE GROUPS EACH OF 96 SUBJECTS TOOK PART IN THE EXPERIMENT, WITH A TOTAL OF 16 STEP AND WINDOW COMBINATIONS. EXPERIMENTAL TRIALS WERE RECORDED ON VIDEOTAPE, AND SUBJECTS WERE ASKED TO RANK EACH CONFIGURATION BY PREFERENCE. RESULTS OF BOTH OBJECTIVE AND SUBJECTIVE MEASUREMENTS SHOWED THAT PROJECTING DESIGNS WERE SUPERIOR TO RECESSED ONES, WITH THE IDEAL LADDER BEING THE BETTER OF THE PROJECTING SOLUTIONS. THE DOUBLE WIDTH FOOTHOLD DESIGN WAS FOUND TO BE THE BETTER OF THE RECESSED SOLUTIONS. WINDOW SIZE AND SILL HEIGHT AFFECTED EXIT TIMES MAINLY FOR ELDERLY MEN AND WOMEN. COMPARISON WITH DATA FROM A PREVIOUS STUDY SHOWED THAT THE OPTIMUM DESIGN FOR AIDING EGRESS AT THE EMERGENCY WINDOW WAS ASSOCIATED WITH EXIT TIMES SLOWER THAN THOSE OBTAINED WITH THE EMERGENCY DOOR BY A FACTOR OF TWO.

by MARY EDWARDS  
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Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P5-14  
Rept. No. C131/77; 1977; 6REFS  
PRESENTED AT A CONFERENCE SPONSORED BY INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977.  
Availability: IN HS-022 527

HS-022 530

**ENVIRONMENTAL REQUIREMENTS FOR PSV [PUBLIC SERVICE VEHICLE] OPERATION [BUSES]**

A REVIEW IS MADE OF ENVIRONMENTAL FACTORS WHICH ARE INCREASINGLY RELEVANT TO PUBLIC SERVICE VEHICLE (BUS) OPERATION AND THE CHALLENGES TO VEHICLE DESIGNERS AND MANUFACTURERS TO PROVIDE EFFECTIVE, RELIABLE AND DURABLE SOLUTIONS WITHIN REALISTIC COST AND WEIGHT LIMITS. EXTERNAL ENVIRONMENTAL FACTORS INCLUDE APPEARANCE AND SIZE, VEHICLE PERFORMANCE, NOISE AND VIBRATION, EMISSIONS, AND AXLE AND VEHICLE WEIGHTS. THOUGH SHAPE AND SIZE ARE PREDICATED BY PURPOSE, OPTIONS EXIST IN TERMS OF PROPORTIONS, COLOR SCHEMES, AND EFFECTIVE FORWARD LENGTH (DISTANCE FROM THE CENTER OF THE NEARSIDE REAR WHEEL TO THE OPPOSITE EXTREME FRONT CORNER OF THE VEHICLE). ADEQUATE ACCELERATION FROM PASSENGER LOADING AND TRAFFIC CONTROL STAGES AND INCREASED MAXIMUM SPEEDS ARE IMPORTANT ASPECTS OF VEHICLE PERFORMANCE. NOISE CONTROL HAS BEEN ATTEMPTED VIA CONTAINMENT, ABSORPTION OR ATTENUATION OF POWER UNIT NOISE. THE PROBLEM OF BRAKE SQUEAL HAS NOT BEEN RESOLVED. CONTROL OF EMISSIONS, VISIBLE AND INVISIBLE, HAS USUALLY RESULTED IN POORER FUEL CONSUMPTION. EFFORTS TO REDUCE NOISE AND MEET HIGHER COMFORT STANDARDS HAVE RESULTED IN HIGHER VEHICLE WEIGHTS. INTERNAL ENVIRONMENTAL FACTORS ARE ALSO RELEVANT TO PUBLIC SERVICE VEHICLE OPERATION. THE DRIVER'S COMPARTMENT SHOULD BE DESIGNED TO PROMOTE COMFORT, EASE IN HANDLING CONTROLS AND COLLECTING FARES, AND SHOULD MINIMIZE WINDSHIELD REFLECTION. RAPID BOARDING AND ALIGHTING ARE IMPORTANT IN URBAN PUBLIC TRANSPORT VEHICLES, BUT DESIGN MUST ACCOMMODATE ELDERLY AND HANDICAPPED PASSENGERS. PERFORMANCE STANDARDS HAVE NOT YET BEEN ESTABLISHED FOR SEATING AND RIDE COMFORT. REALISTIC VALUES FOR ACCEPTABLE INTERNAL NOISE LEVELS CAN BE DETERMINED BY MEASURING THE MAXIMUM SOUND PRESSURE LEVEL. MINIMUM HEATING AND VENTILATION STANDARDS HAVE BEEN EFFECTIVELY PRESCRIBED FOR SOME YEARS. VISIBILITY AND ILLUMINATION HAVE BEEN ACHIEVED BY LARGE AREAS OF GLASS AND INTERNAL LIGHTING.

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LEYLAND TRUCK AND BUS CO., PRESTON, ENGLAND  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P15-24  
Rept. No. C132/77; 1977  
PRESENTED AT A CONFERENCE SPONSORED BY INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977.  
Availability: IN HS-022 527

HS-022 531

**STATUTORY TECHNICAL CONTROL OF PUBLIC SERVICE VEHICLES [BUSES] [UNITED KINGDOM]**

PUBLIC SERVICE VEHICLES (PSV) TECHNICAL ENFORCEMENT ACTIVITIES IN ENGLAND ARE REVIEWED AND COMPARED WITH INFORMATION ON SIMILAR ACTIVITIES IN COUNTRIES WHICH ARE MEMBERS OF THE INTERNATIONAL MOTOR VEHICLE INSPECTION COM. (CITA). CENTRAL GOVERNMENT BECAME DIRECTLY INVOLVED WITH THE SUPERVISION OF BOTH CONSTRUCTIONAL AND MAINTENANCE STANDARDS OF PUBLIC SERVICE VEHICLES (BUSES, COACHES, ETC.) LARGELY AS A RESULT OF THE 1930 ROAD TRAFFIC ACT, THE PROVISIONS OF WHICH WERE REAFFIRMED IN THE 1960 ROAD TRAFFIC ACT. THE ISSUANCE OF A CERTIFICATE OF FITNESS FOR A PSV BY A CERTIFYING OFFICER IS NECESSARY BEFORE THE TRAFFIC COMMISSIONER FOR THE AREA IN WHICH A VEHICLE IS BASED CAN GRANT A PSV LICENSE FOR IT TO OPERATE FOR HIRE OR REWARD ON A PUBLIC HIGHWAY. CERTIFYING OFFICERS AND VEHICLE EXAMINERS ARE EMPOWERED TO ISSUE AND SUSPEND LICENSES AND TO INSPECT VEHICLES ON AN ANNUAL AND SPOT CHECK BASIS. ACCIDENT STATISTICS REFLECT HIGH PASSENGER SAFETY STANDARDS FOR PSV'S OVER THE LAST TEN YEARS, ALTHOUGH THEY ARE MORE LIKELY THAN OTHER VEHICLES TO BE INVOLVED IN FATAL AND PEDESTRIAN ROAD ACCIDENTS. COST BENEFIT ANALYSIS OF BASIC PSV MAINTENANCE EXPENSE COMPARED WITH SAFETY RECORDS INDICATES THAT INSPECTION STANDARDS ARE WORTHWHILE. PSV STANDARDS AND INSPECTION PROCEDURES VARY WIDELY FROM COUNTRY TO COUNTRY, THE STANDARDS AND FORMALITY OF INSPECTIONS VARYING FROM STRICT TO LESS FORMAL. SUSPENSION NOTICES ISSUED IN GREAT BRITAIN FOR A SIX-MONTH PERIOD IN 1976 SHOW A LICENSE SUSPENSION RATE OF 4.58%. BRAKES WERE FOUND TO BE DEFECTIVE MORE THAN ANY OTHER ONE COMPONENT.

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Publ: HS-022 527 (I-MECH-E-CONFERENCE-

PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P25-35

Rept. No. C133/77; 1977

PRESENTED AT A CONFERENCE SPONSORED BY INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977.

Availability: IN HS-022 527

HS-022 532

**HEATING AND VENTILATING [OF BUSES] IN U.K. [UNITED KINGDOM]**

THE HISTORY OF HEATING, VENTILATING, AND DEMISTING ON PUBLIC SERVICE VEHICLES (PSV) (BUSES) IN THE UNITED KINGDOM IS CHARACTERIZED BY DEVELOPMENT OF INCREASINGLY SOPHISTICATED SYSTEM DESIGN REQUIREMENTS

LEADING TO IMPROVED ATMOSPHERIC CONDITIONS. MOST VEHICLE HEATERS USE ENGINE COOLANT AS THE HEAT SOURCE, WATER BEING AN EXCELLENT MEDIUM FOR HEAT TRANSFER AND HEAT TRANSPORT. HEATERS HAVE BEEN BULKHEAD-MOUNTED, CANOPY-MOUNTED, HOUSED UNDER SEATS, OR DUCTED. HEATING AND VENTILATION ARE COMBINED BY PROVIDING HEATERS WITH FRESH AIR INTAKES AND TURNING OFF THEIR COOLANT SUPPLY IN SUMMER. FRONT WINDSHIELD DEMISTING AND CAB HEATING IS PROVIDED BY FRESH AIR DELIVERED IN A FLAT JET AT AN ANGLE OF ABOUT 25° WITH THE WINDSHIELD COMBINED WITH RECIRCULATORY HEATING. A 1968 BUS GRANT SCHEME, INTRODUCED TO ACCELERATE VEHICLE REPLACEMENT AND STANDARDIZATION, SPECIFIES MINIMUM PERFORMANCE FIGURES FOR HEATING, DEMISTING, AND VENTILATION. SOME LESS CONVENTIONAL SYSTEMS COMBINING ENGINE COOLING WITH HEATING AND VENTILATION, WITH AUTOMATIC CONTROL, INCLUDE THE CAVE-BROWNE-CAVE SYSTEM, THE UHV SYSTEM, THE KL 650 AUTOMATIC, AND THE COMPAS SYSTEM. HEATER LAYOUT DESIGN IS GOVERNED BY BODY DESIGN AND ENGINE POSITION, SEATING ARRANGEMENT, AND COST. SOME BASIC TECHNICAL REQUIREMENTS INCLUDE AIR INDUCTION, TAPPING SIZES OF ENGINE CONNECTIONS, FRESH AIR INLETS, AND WATER PUMPS. EARLIER COLLABORATION BETWEEN CHASSIS AND BODY MANUFACTURERS IS ESSENTIAL. EFFICIENCY IN THE USE OF FUELS IS PREDICTED AS THE LIKELIEST SPUR TO DEVELOPMENT.

by A. J. WALL

CLAYTON DEWANDRE CO., LTD., LINCOLN, ENGLAND

Publ: HS-022 527 (I-MECH-E-CONFERENCE-

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HS-022 533

**DESIGN, CONSTRUCTION AND APPLICATION OF AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE] SUSPENSION [BUSES]**

AIR SPRINGS, USED IN VEHICLE SUSPENSIONS SINCE THE EARLY 20TH CENTURY, ARE COMPRISED OF THE CARCASS, BEAD RING, AND RUBBER SURFACE COVERINGS WHICH MAKE UP THE FLEXIBLE BELLOW OR DIAPHRAGM COMPONENT FITTED TO TOP AND BOTTOM MOUNTING METALWORK TO PRODUCE THE PRACTICAL AIR SPRING ASSEMBLY. APPLICATION OF COMPRESSED AIR TO THE ASSEMBLY CAUSES THE FLEXIBLE ELEMENT TO INFLATE TO PRODUCE FORCE REACTIONS AT END MOUNTINGS. TWO BASIC AIR SPRING TYPES ARE THE CONVOLUTED BELLOW AND THE ROLLING DIAPHRAGM. THE STATIC LOAD CAPACITY OF AN AIR SPRING IS A FUNCTION OF THE SIZE AND GEOMETRIC SHAPE OF THE INFLATED ASSEMBLY.

VARIETY OF CONVENTIONAL GEOMETRIC SUSPENSION ARRANGEMENTS. THE SUSPENSION DESIGN REQUIRES THE PROVISION OF A PNEUMATIC POWER/CONTROL CIRCUIT. FOR A CONVENTIONAL LOW-PRESSURE INSTALLATION, A LOW-PRESSURE CIRCUIT IS USED, WHEREAS A HIGH-PRESSURE CIRCUIT CAN BE USED IN LESS COMMON INSTALLATIONS, ALLOWING OPERATION OF AIR SPRINGS AT A MUCH HIGHER STATIC LOAD PRESSURE. DESIGN OF THE SUSPENSION CIRCUIT VARIES ACCORDING TO THE REQUIREMENTS OF SINGLE, TANDEM, AND MULTI-AXLE WHEEL STATIONS AND THE NATURE OF THE LOAD DISTRIBUTION. LEVELING AND ISOLATOR VALVES VARY IN CONSTRUCTION AND LOCATION WITHIN THE SYSTEM. SUSPENSION DYNAMICS REFER TO THE MANNER IN WHICH THE SUSPENSION SYSTEM WILL ISOLATE THE VEHICLE FROM VIBRATIONS AND AFFECT HANDLING CONTROL AND STABILITY. PHYSICAL, ENVIRONMENTAL, AND ENDURANCE TESTING HAS BEEN USED TO EVALUATE AIR SPRINGS. VARIABLE RATE SPRINGS ADAPT TO LADEN VERSUS UNLADEN LOAD CONDITIONS, WHEREAS CONSTANT RATE SPRINGS DO NOT.

by R. J. PEEL  
DUNLOP LTD., SUSPENSIONS DIV., COVENTRY, ENGLAND  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P45-58  
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Availability: IN HS-022 527

HS-022 534

#### **HYDRAULIC SUSPENSIONS WITH PARTICULAR REFERENCE TO PUBLIC SERVICE VEHICLES [BUSES]**

AN ACTIVE RIDE CONTROL SYSTEM HAS BEEN DEVELOPED FOR ROAD VEHICLES USING HYDRAULIC STRUTS AND A GAS SPRING IN PLACE OF THE CONVENTIONAL COIL OR LEAF SPRING. IN THE FRONT SUSPENSION OF A TEST BUS, UNEQUAL WISHBONES ARE EMPLOYED WHICH SUPPORT THE KING PIN, STUB AXLE, AND WHEEL ASSEMBLY WHICH ARE IN TURN CARRIED BACK TO THE BODY BY THE HYDRAULIC STRUT. THE REAR SUSPENSION WAS OF THE TRAILING SUBFRAME VARIETY WITH PARALLEL LONGITUDINAL SIDE MEMBERS BRANCHING OUT BEHIND THE REAR WHEELS WITH SUPPORT TO THE BODY AT WHEEL TRACK WIDTH. THE THEORETICAL BASIS OF ACTIVE SUSPENSION CAN BE DEMONSTRATED BY CONSIDERING A MONOCYCLE SYSTEM. THE KEY TO SATISFACTORY OPERATION OF ACTIVE RIDE CONTROL LIES IN THE CONTROL LOGIC'S ABILITY TO DISCRIMINATE RAPIDLY BETWEEN RIDE AND HANDLING MOTIONS AND TO HAVE A POWER SOURCE AVAILABLE THAT IS CAPA-

THE MAIN SUSPENSION SPRING SUCH THAT THE BODY ATTITUDE CAN BE CONTROLLED BY REGULATING THE VOLUME OF FLUID IN THE STRUT. THE FLUID SERVES TO CONTROL THE RIDE IN RESPECT TO PITCH, BOUNCE, AND ROLL TO GIVE IMPROVED COMFORT, HANDLING, AND ROAD ADHESION. A COMPUTER MODEL USED TO EXPLORE VARIOUS PARAMETERS CONFIRMED PRACTICAL EXPERIENCE AND SHOWED THAT IT WAS NOT A FEASIBLE PROPOSITION TO ASSIST THE WHEEL UP AND DOWN OVER OBSTACLES. RIDE QUALITY, TILT TABLE, AND BRAKING TESTS WERE PERFORMED TO ASSESS THE ACTIVE HYDRAULIC SUSPENSION SYSTEM. RESULTS INDICATE THAT THE SYSTEM ALLOWS A COMPARATIVELY SOFT PASSIVE SUSPENSION WHICH PRODUCES A COMFORTABLE RIDE WITHOUT THE PENALTY OF LARGE STATIC DEFLECTIONS TOGETHER WITH CONTROL OF BODY ROLL WHEN CORNERING AND BODY PITCH WHEN BRAKING.

by R. H. PITCHER; H. HILLEL; C. H. CURTIS  
AUTOMOTIVE PRODUCTS, LEAMINGTON SPA, ENGLAND; LONDON TRANSPORT, ACTON WORKS, 130 BOLLO LANE, LONDON W3, ENGLAND  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P59-65  
Rept. No. C138/77; 1977; 1REF  
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HS-022 535

#### **INVESTIGATION OF PSV [PUBLIC SERVICE VEHICLE] ROLL OVER SAFETY [BUSES]**

THE ROLLOVER PROBLEM OF SINGLE-DECK PUBLIC SERVICE VEHICLES (PSV) (BUSES) HAS BEEN EXAMINED BY CARRYING OUT ON THE SPOT ACCIDENT INVESTIGATIONS, THEORETICAL EVALUATION, AND EXPERIMENTAL TESTING. DETAILED INVESTIGATIONS OF NINE PSV ACCIDENTS INDICATE THAT THE STANDARD ACCIDENT OF ROLLING DOWN A SLOPE FROM REST IS VERY SEVERE. CONCLUSIONS RELY ON THE FACT THAT THE MAJORITY OF ACCIDENTS ONLY INVOLVE A SINGLE ROLL ONTO THE ROOF, GIVING ONE CASE OF DIAGONAL LOADING ON THE CANT RAIL, WHILE A COMPLETE ROLLOVER DOWN A SLOPE IMPLIES A REVERSE DIAGONAL LOADING ON THE OPPOSITE CANT RAIL APPLIED AFTER THE FIRST LOADING. MAKING THE PSV STRUCTURE ADEQUATE TO ABSORB THE ENERGY REQUIRED FOR ONE DIAGONAL IMPACT WOULD CONSIDERABLY IMPROVE PERFORMANCE IN THESE CASES. EVIDENCE INDICATES THAT IF PASSENGERS CAN BE RETAINED INSIDE THE VEHICLE, FATALITIES ARE UNLIKELY EVEN IF THE ROOF OR THE LUGGAGE RACK TOUCHES THE HIGH SEAT BACKS PROVIDED IN MOST TOURING COACHES. TEST RIGS WERE USED FOR STATIC AND PENDULUM TESTS OF INDIVIDUAL

SIDERABLE REDESIGN WILL BE NECESSARY TO MEET ANY REASONABLE DIAGONAL LOADING REQUIREMENT. DESIGN FOR ROLLOVER SAFETY CAN BE IMPROVED BY USING DUCTILE MATERIALS FOR THE MAIN LOAD CARRYING STRUCTURE WHICH CAN ABSORB DEFORMATION ENERGY WITHOUT FRACTURE. SIZE OF THE SIDE WINDOWS SHOULD BE REDUCED AND MORE STRUCTURAL RINGS PROVIDED. THE MAIN STRUCTURAL JOINTS SHOULD BE DESIGNED TO TRANSFER THE MAXIMUM BENDING MOMENT THAT CAN BE SUSTAINED BY THE BEAMS AT THEIR COLLAPSE LOADS.

by D. KECMAN; J. C. MILES; M. M. SADEGHI; G. H. TIDBURY

CRANFIELD INST. OF TECH., SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, BEDS., ENGLAND

Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P67-76

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Availability: IN HS-022 527

AT PRESENT WILL HASTEN THE INTRODUCTION OF INTEGRALLY LOCATED HYDRAULIC RETARDERS, REGENERATIVE BRAKING SYSTEMS, AND UNIFIED POWER SYSTEMS TO DRIVE THE MAJORITY OF COMPONENTS, MAKING VEHICLE INTERCHANGEABILITY MORE FEASIBLE. APPENDICES SHOW VEHICLE KILOMETERS, PASSENGER JOURNEYS, AND VEHICLE STOCK APPORTIONED AMONG STAGE, EXPRESS, EXCURSIONS AND TOURS, AND CONTRACT AND PRIVATE HIRE SERVICES FOR ALL UNITED KINGDOM OPERATORS.

by P. H. WYKE SMITH

NATIONAL BUS CO., LONDON, ENGLAND

Publ: HS-022 527 (I-MECH-E-CONFERENCE-

PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P77-82

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HS-022 537

## **BRAKING BUSES**

PROBLEMS IN DESIGNING AND OPERATING PUBLIC SERVICE VEHICLE (BUS) BRAKES AND SYSTEMS INCLUDE EXCESSIVELY HIGH TEMPERATURE, AIR CONTAMINATION, AND STABILITY. AIR CONTAMINATION AND EXCESSIVE BRAKE TEMPERATURES HAVE A MUTUALLY EXACERBATING EFFECT AND GIVE RISE TO THE MAJOR OPERATING PROBLEMS OF POOR LIFE AND NOISY OPERATION. TEMPERATURE REDUCTION CAN BE ACHIEVED BY REDUCING ENERGY INPUT PER BRAKE OR INCREASING COOLING RATES. THE EUROPEAN ECONOMIC COMMUNITY DIRECTIVE EEC 75-524 REQUIRES HIGHER PERFORMANCE STANDARDS THAN CURRENT BRITISH LEGISLATION, NECESSITATING MORE COMPLICATED BRAKING SYSTEMS WHICH ARE ACTUALLY ALREADY INSTITUTED BY MANUFACTURERS. RETARDERS WILL BECOME NECESSARY TO MEET EEC STANDARDS FOR HEAVIER VEHICLES EXCEPT IN A FEW CASES WHERE ENGINE BRAKING IS SUBSTANTIAL. RETARDERS NEED TO BE MODULATED TO PREVENT INSTABILITY AND COMPLY WITH EEC 75-524. RETARDERS CAN BE OF GREAT BENEFIT IN OFFLOADING ENERGY FROM THE FOUNDATION BRAKES. THE MAJOR OBSTACLE TO RETARDERS (AS DISTINCT FROM EXHAUST BRAKES) IS THE PACKAGING PROBLEM, PARTICULARLY FOR REAR ENGINED VEHICLES. IF THE PACKAGING PROBLEM CAN BE OVERCOME, HOWEVER, THERE IS MUCH POTENTIAL BENEFIT FROM EXTRA BRAKING CAPACITY. MAJOR DEPARTURES FROM CONVENTIONAL PRACTICE ARE INHIBITED BY THE EFFECT ON COST AND SPARES STOCKHOLDING. APART FROM POWER HYDRAULICS, RETARDERS ARE PROBABLY THE MOST SIGNIFICANT INNOVATION FOR THE NEXT GENERATION OF VEHICLES. NEVERTHELESS, POWER HYDRAULIC SYSTEMS AND DISC BRAKES ARE BEING ACTIVELY

HS-022 536

## **VEHICLE TYPES IN RELATION TO SPECIFIC OPERATING CONDITIONS [UNITED KINGDOM] [BUSES]**

CATEGORIES OF BUS AND COACH SERVICES IN THE UNITED KINGDOM ARE DESCRIBED IN TERMS OF COMPARATIVE PROPORTIONS OF EACH TYPE OF SERVICE TO THE TOTAL OPERATION. OVERSHADOWING THE CONSIDERATION OF SPECIALIZED VEHICLE TYPES TO SUIT PARTICULAR OPERATING REQUIREMENTS IS THE FUNDAMENTAL PRINCIPLE THAT FLEET COMPOSITION MUST PROVIDE THE MAXIMUM FREEDOM OF OPERATION. THE NATIONAL BUS CO. AIMS TO MOVE TOWARD 100% ONE-PERSON OPERATION OF ALL ITS VEHICLES AS WELL AS NEAR 100% FLEET INTERCHANGEABILITY AS A PREREQUISITE TO RETAINING EFFECTIVE CONTROL OF OPERATING COSTS. THREE CATEGORIES OF SERVICES ARE THE TERRITORIAL OPERATOR (INCLUDING SPECIAL HIRES SUCH AS EXTENDED TOURING AND SCHOOL CONTRACT), URBAN OPERATIONS IN METROPOLITAN AND PRECINCT AREAS, AND MIXED TERRITORIAL OPERATIONS WHICH ADDITIONALLY INVOLVE RURAL AND INTERURBAN SERVICES. TOTAL OPERATIONS IN TERMS OF VEHICLE KILOMETERS ARE BROADLY 30% URBAN, 54% FOR INTERURBAN AND RURAL OR SEMIRURAL, AND 16% FOR COACHING. ALTHOUGH EACH TYPE OF SERVICE HAS PARTICULAR SPECIFICATION NEEDS, SUCH AS HEAVY-DUTY PERFORMANCE VERSUS STYLE AND COMFORT, COMPROMISE IS ESSENTIAL FOR ECONOMIC AND REGULATORY PURPOSES. THE ACHIEVEMENT OF THE MULTIPURPOSE BUS, HOWEVER, HAS NEVER BEEN FULLY REALIZED FOR SOUNDLY BASED MARKET,

HS-022 538

PURSUED. BOTH HIGH PRESSURE AIR AND ELECTRICALLY CONTROLLED AIR SYSTEMS SHOULD BE INVESTIGATED.

by I. R. SLACK  
SPURRIER WORKS, LEYLAND, PRESTON, ENGLAND  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P83-96  
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HS-022 538

#### **ALLISON AUTOMATIC TRANSMISSIONS FOR PUBLIC SERVICE VEHICLES [BUSES]**

EVOLUTION OF THE DETROIT DIESEL ALLISON RANGE OF AUTOMATIC TRANSMISSIONS AND ITS APPLICATION TO VARIOUS EUROPEAN PUBLIC SERVICE VEHICLES (PSV) IS DESCRIBED. THE FIRST V-DRIVE TRANSMISSION, PATENTED IN THE U.S. IN 1932, WAS FOLLOWED IN 1948 BY GMC'S ALLISON V TRANSMISSION WHICH FEATURED A BEVEL GEAR SET AHEAD OF THE TORQUE CONVERTER INSTEAD OF BEHIND IT. IN 1971, AFTER A SERIES OF CHANGES IN TRANSMISSION CONFIGURATIONS, THE ALLISON V730 WAS DEVELOPED. IN GENERAL, U.S. COACHES HAVE MUCH HIGHER POWER TO WEIGHT RATIOS THAN THOSE IN USE IN EUROPE, ESPECIALLY IN THE UNITED KINGDOM. ALLISON AUTOMATIC TRANSMISSIONS INTRODUCED IN 1971 FOR THE TRUCK MARKET UTILIZE FULLY AUTOMATIC RANGE SELECTION, HYDRAULIC TORQUE CONVERTER, PLANETARY GEARS, AND CLUTCH PACKS. ALL BUT THE AT 540 ARE FITTED WITH A LOCK-UP CLUTCH. AUTOMATIC SHIFTS ARE ACCOMPLISHED BY MEANS OF MULTIDISK, SELFADJUSTING, HYDRAULIC CLUTCHES. A TWO-GEAR, FIXED-DISPLACEMENT PUMP IS USED TO PROVIDE OIL FOR SYSTEM PRESSURE, COOLING, AND LUBRICATION. EUROPEAN REQUIREMENTS AFFECTING TRANSMISSION SPECIFICATIONS INVOLVE ENGINE-TORQUE CONVERTER MATCHING; POWER TO WEIGHT RATIOS AND GRADEABILITY; VEHICLE BRAKING; AND SPEEDOMETER GEAR RATIOS. TYPICAL EUROPEAN PSV APPLICATIONS OF ALLISON AT 540 AND AT 543 TRANSMISSIONS INCLUDE THE BEDFORD J1L MIDI BUS AND THE FORD R1014 COACH. MT 640 AND MT 644 TRANSMISSION DESIGNS ARE UTILIZED IN THE FODEN AND AILSA DOUBLE DECK BUSES, AND THE CIE DOUBLE DECK AND SINGLE DECK TEST VEHICLES. THE U.S. V730 TRANSMISSION IS ADAPTED FOR EUROPEAN USE IN THE VAN HOOL SINGLE DECK BUS.

by D. NICHOLSON  
DETROIT DIESEL ALLISON INTERNATIONAL,  
WELLINGBOROUGH, ENGLAND  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN,

HSL 78-08

CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P97-104  
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#### **ANALYTICAL COMPARISON OF INTEGRAL AND CHASSIS DESIGN ON BUSES**

COMPARATIVE COMPUTATIONAL INVESTIGATIONS OF VARIOUS BUS DESIGNS, INTEGRAL AND CHASSIS DESIGN, HAVE BEEN CARRIED OUT USING THE FINITE ELEMENT METHOD. THE METHOD OF STRUCTURAL ANALYSIS FOR DETERMINING DYNAMIC STRESS IS CONFINED TO A MATHEMATICAL COMPARISON WHICH AIDS IN CALCULATING COMPLEX SUPPORTING STRUCTURES AND ANALYZING PHYSICAL PROPERTIES OF A STRUCTURE STATICALLY AS WELL AS DYNAMICALLY. WHEN APPLYING THE FINITE ELEMENT METHOD, THE STRUCTURE TO BE ANALYZED IS SPLIT UP INTO A NETWORK OF PLATE, BAR, AND OTHER ELEMENTS. USING LARGE-SCALE COMPUTER PROGRAMS, THE OVERALL BEHAVIOR OF THE COMPLEX STRUCTURE FOR THE SELECTED PARTS IS DETERMINED FROM INDIVIDUAL CHARACTERISTICS OF THE ELEMENTS. EVEN UNDER CONDITIONS OF STATIC LOAD THE STRESSES IN THE BODY ARE SLIGHTLY HIGHER IN CHASSIS DESIGN THAN IN INTEGRAL DESIGN VEHICLES, IN SPITE OF THE ADDITIONAL WEIGHT OF CHASSIS VEHICLES. WHEN DYNAMIC LOADS ARE APPLIED BY MEANS OF STOCHASTIC EXCITATION OF THE FOUR WHEELS THIS DISCREPANCY BECOMES EVEN GREATER, AND AN ADDITIONAL WEIGHT PENALTY IS IMPLIED. THE FRAME STRESSES IN THE CHASSIS DESIGN ARE CONSIDERABLY HIGHER THAN IN THE SPACIOUS FLOOR ASSEMBLY OF A BUS IN INTEGRAL DESIGN. THE BODY, PARTICULARLY WHEN NOT OF THE SELFSUPPORTING TYPE, IS UNABLE TO GIVE SUFFICIENT SUPPORT TO THE FRAME, BECAUSE OF FLEXIBLE CONNECTIONS OR FOR LACK OF INHERENT STIFFNESS. IN CHASSIS TYPE VEHICLES THE BODY ITSELF, UNLESS MADE HEAVIER BY WAY OF COMPENSATION, IS ALSO SUBJECT TO HIGHER PEAK STRESSES, COMBINED WITH LOWER NATURAL FREQUENCIES OF THE VARIOUS MODE SHAPES, WHICH ARE AS A RULE LESS FAVORABLE. A STRENGTH AND VIBRATION RESPONSE ANALYSIS OF BUS STRUCTURES REVEALS THAT THE INTEGRAL DESIGN HAS CONSIDERABLE ADVANTAGES.

by L. PRESSEL; P. STRIFLER  
DAIMLER-BENZ AKTIENGESSELLSCHAFT,  
STUTTGART, GERMANY  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION, AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P105-110  
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August 31, 1978

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HS-022 540

### **BUS RESEARCH AND DEVELOPMENT AT AUTOKUT RESEARCH INSTITUTE, HUNGARY**

RESEARCH AND TESTING IN THE FIELD OF PASSIVE SAFETY OF BUSES AND LIFE PREDICTION OF BUS STRUCTURES IS REPORTED. STATISTICS ON ROLLOVER ACCIDENTS HAVE BEEN COLLECTED TO DETERMINE AND DESIGN SUFFICIENTLY STRONG SUPERSTRUCTURES. ANALYSIS IS BASED ON COMPUTER SIMULATION, ROLLOVER TESTS ON SMALL SCALE MODELS, AND TESTS ON REAL BUSES. RESEARCH ON SAFETY BUMPER SYSTEMS HAS BEEN CARRIED OUT USING STATIC AND DYNAMIC PENDULUM TESTS. POSSIBLE ABSORPTION IMPROVEMENTS INCLUDE HYDRAULIC AND PNEUMATIC ABSORPTION, AND FRICTION AND DEFORMATION WORK. INCREASING PASSIVE REINFORCING SAFETY OF THE DRIVER'S COMPARTMENT CAN BE ACCOMPLISHED BY REINFORCING THE HORIZONTAL RAILS IN THE FRONT WALL OF THE BUS UNDER THE WINDSHIELD; BY DEVELOPING A SAFETY PLATFORM; AND BY INCREASING STRENGTH AND FIXING OF THE DRIVER'S SEAT. PASSENGER SEATS SHOULD BE CONSTRUCTED AND FASTENED WITH THE AIM OF ABSORBING ENERGY DURING LIMITED DEFORMATION AND RESTRAINING AND PROTECTING PASSENGERS. THE STRENGTH AND FATIGUE DAMAGE PROCESS ON BUSES WAS STUDIED ON FOUR STRUCTURAL LEVELS, INCLUDING THE COMPLETE STRUCTURE, STRUCTURAL ELEMENTS AND PARTS, THE CRITICAL CROSS SECTIONS OF THE ELEMENTS, AND THE POINT AND THE IMMEDIATE NEIGHBORHOOD OF STRESS CONCENTRATIONS. RESULTS ARE SUMMARIZED IN TABULAR FORM.

by M. MATOLCSY  
AUTOPARI KUTATO INTEZET, BUDAPEST, HUNGARY  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION, AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P113-128  
1977; 26REFS  
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### **THE CHOICE OF MATERIALS IN THE DESIGN AND CONSTRUCTION OF PUBLIC SERVICE VEHICLES [BUSES]**

MATERIALS FOR BODY AND CHASSIS EXTERIOR USE ARE EXAMINED IN TERMS OF CHOICES AVAILABLE, DURABILITY, WEIGHT SAVING, FIRE RETARDANCE, AND NOISE ABSORPTION. TWO TYPES OF UNDERSTRUCTURE CHASSIS FRAMES ARE THE CONVENTIONAL FRAME CHASSIS WITH PRINCIPAL SIDE MEMBERS FORMED FROM STEEL STRIP, AND THE INTEGRAL STRUCTURE NARROWER STEEL STRIP AND PLATE. THE UNDER SECTION OF AN INTEGRAL BUS HAS BEEN CONSTRUCTED OF GALVANIZED STEEL COATED WITH ZINC. CORROSION RESISTANCE IS PROVIDED WHEN THE ZINC IS PAINTED. GLASS-

REINFORCED PLASTIC, ALUMINUM, AND LOW-CARBON STEEL ARE THE PRINCIPAL BODY STRUCTURE AND SHELL MATERIALS. CORROSION PROBLEMS ARE BEING SOLVED BY HOT DIP GALVANIZED STEEL WITH ADDITIONAL PAINTING, OR BY AN IRON/ZINC ALLOY COATED STEEL. PANELING IS USUALLY FASTENED BY SOME FORM OF RIVETING, OFTEN THROUGH AN EDGE SEALER STRIP. BUS FLOORS ARE USUALLY CONSTRUCTED OF TROPICAL OR EUROPEAN HARD TIMBER PLYWOOD AND FIREPROOFED. COMPOSITE FLOORS WITH LIGHTWEIGHT CORES HAVE BEEN INVESTIGATED TO ACHIEVE WEIGHT SAVINGS AND IMPROVED FLOOR THERMAL INSULATION. FATIGUE LIFE OF BOLTED, RIVETED, AND WELDED JOINTS VARIES ACCORDING TO PARENT METAL COMBINATION, MATERIAL SURFACE FINISH, BOLT/RIVET OR WELD TYPE, HOLE CLEARANCE, METHOD OF HOLE FORMING, AND CLAMPING FORCE. NONSTRUCTURAL BODY MATERIALS WHICH ARE IMPORTANT FOR SAFETY, MAINTENANCE, AND AESTHETICS INCLUDE FLOOR TREAD MATERIALS AND SEATING, WHICH CAN BE FABRICATED FROM NUMEROUS DIFFERENT TYPES OF SYNTHETIC AND NATURAL MATERIALS. INTERIOR TRIM MATERIALS ARE OFTEN PLASTIC LAMINATES. INSULATION IS IMPORTANT TO PROTECT FROM MAJOR HEAT LOSSES.

by M. J. HANNAM; R. SMETHURST  
BRITISH LEYLAND TRUCK AND BUS GROUP, ENGLAND  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION, AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P129-35  
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### **THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION**

REVIEW IS MADE OF THE CURRENT PERFORMANCE OF POWER UNITS AND TRANSMISSIONS AND THEIR DEVELOPMENT OVER THE LAST TWO DECADES. PERFORMANCE OF THESE TWO FUNDAMENTAL COMPONENTS HAS BEEN SIGNIFICANTLY IMPROVED IN DETAIL BUT FAILURES HAVE RESULTED, PROBABLY FROM OVERSOPHISTICATION IN OVERALL VEHICLE DESIGN, WHICH HAS BEEN DICTATED BY THE OPERATOR IN RESPONSE TO OPERATING CONDITION CHANGES AND INCREASED TRAFFIC DENSITY. SECONDARY FUELS, OR THE USE OF ELECTRICAL POWER, ARE A POTENTIAL ALTERNATIVE POWER SOURCE ALTHOUGH THEY INVOLVE HIGH CAPITAL COST IN SUPPORT SYSTEMS. PRIMARY FUELS, OR FOSSIL FUEL DERIVATIVES (GASOLINE AND LIGHT GAS OIL) WHICH ARE NOW WIDELY USED WILL PROBABLY RUN SHORT WITHIN A FINITE PERIOD. SIZE AND ECONOMIC CONSTRAINTS HAVE LIMITED THE DEVELOPMENT OF MORE EFFICIENT COMPRES-

SION IGNITION ENGINES. AUXILIARY DRIVES, COOLING, INDUCTION, AND EXHAUST SYSTEMS HAVE BECOME INCREASINGLY COMPLEX WITHOUT IMPROVED SERVICEABILITY. METHODS OF CONTROLLING NOISE OUTPUT AND EXHAUST EMISSIONS IN THE POWER UNIT HAVE BEEN DEVELOPED, BUT ARE SEEN BY THE OPERATOR AS NEGATIVE INFLUENCES ON OVERALL EFFICIENCY. POWER OUTPUT STANDARDS, AS THEY HAVE BEEN RAISED, DO NOT MEAN THAT ENGINES HAVE A GOOD TORQUE CHARACTERISTIC NOR THAT THE TRANSMISSION IS MATCHED TO PROVIDE ADEQUATE VEHICLE ACCELERATION AND STARTING GRADEABILITY. CURRENTLY USED TRANSMISSIONS HAVE REMOTE POWER OPERATION GEARBOXES BUT HAVE GAINED A POOR REPUTATION DUE TO LOW OPERATIONAL LIFE AND POOR RELIABILITY. ALTERNATIVES INCLUDE HYDRODYNAMIC (TORQUE CONVERTER) TRANSMISSIONS, EPICYCLIC GEARBOXES, FLUID COUPLINGS, CONSTANT MESH GEARBOXES, HYDROSTATIC TRANSMISSIONS, AND AUTOMATIC CONTROL SYSTEMS.

by R. E. FREELOVE

Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION, AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P137-43  
Rept. No. C147/77; 1977

PRESENTED AT A CONFERENCE SPONSORED BY INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 1-13 JUL 1977.  
Availability: IN HS-022 527

HS-022 543

# **PLASTIC DEFORMATIONS AND ENERGY CONSUMPTION AT DYNAMIC (IMPACT) LOADS**

STABILITY TESTS OF THIN-WALLED TUBES WITH RECTANGULAR CROSS SECTIONS HAVE BEEN MADE UNDER DYNAMIC AXIAL LOADS IN ORDER TO EVALUATE STABILITY AND DEFORMATION CHARACTERISTICS AND TO DETERMINE WHAT SORT OF CORRELATION EXISTS BETWEEN STATIC AND DYNAMIC STRUCTURAL CHARACTERISTICS. THE STOCHASTIC FEATURE HAS BEEN EXAMINED OF THE TRANSITION FROM STABILITY INTO INSTABILITY TO WORK OUT MEASURING TECHNIQUES TO BE EMPLOYED FOR DETERMINATION OF THE INDIVIDUAL PARAMETERS INVOLVED. A SQUARE-SECTION MEMBER OF 40 BY 40 BY 2 MM TUBE WAS USED. RESULTS INDICATE THAT AT A SPECIFIC SPEED, THE ULTIMATE LOAD HAS A MAXIMUM AND ABOVE A CERTAIN SPEED VALUE THE CRITICAL LOAD WILL BE SMALLER COMPARED TO THAT OBTAINED IN THE STATIC TEST. THE HEAVIER THE IMPACT WEIGHTS, THE LARGER WILL BE THE ULTIMATE LOADS. CORRELATION BETWEEN STATIC AND DYNAMIC TESTS WAS FOUND TO EXIST IF APPLICATION OF LOAD, DISTRIBUTION OF LOAD, AND BOUNDARY CONDITIONS ARE THE SAME FOR BOTH TYPES OF TESTS. STATIC AND DYNAMIC TESTS ON ENERGY-ABSORBING ELEMENTS USED TO MAKE PART OF THE SAFETY BUMPER SYSTEM ON BUSES YIELDED RESULTS SIMILAR TO THOSE TESTS CONDUCTED ON TUBING. DYNAMIC TESTS HAVE PROVED THAT INSTABILITY

AND DEFORMATION CAN BE CHARACTERIZED BY SEVERAL FEATURES: IMPACT FORCE VERSUS TIME DIAGRAM, COMPRESSION VERSUS TIME DIAGRAM, AND MAXIMUM COMPRESSION. FURTHER COMPARISONS OF ENERGY DENSITY FUNCTIONS UNDER STATIC AND DYNAMIC TEST CONDITIONS REQUIRE COMPUTER ANALYSIS.

by C. MOLNAR

RES. INST. OF AUTOMOBILE INDUSTRY, BUDAPEST, HUNGARY

Publ: HS-022 527 (I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6), "THE DESIGN, CONSTRUCTION, AND OPERATION OF PUBLIC SERVICE VEHICLES," LONDON, 1977 P145-52  
Rept. No. C148/77; 1977

PRESENTED AT A CONFERENCE SPONSORED BY INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977.  
Availability: IN HS-022 527

HS-022 544

# **THE NATIONAL PSV [PUBLIC SERVICE VEHICLE] ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED STUDY [BUSES]**

A NATIONAL PUBLIC SERVICE VEHICLE (PSV) SURVEY IS A COOPERATIVE VENTURE INSTITUTED TO RESEARCH AND RECORD SERIOUS BUS ACCIDENTS, DEFINED AS ACCIDENTS INVOLVING HOSPITAL TREATED INJURY OR VERY EXTENSIVE VEHICLE DAMAGE, THE DETAILS OF WHICH WILL BE HELD IN A COMPUTER-BASED DATA BANK FOR RAPID INFORMATION RETRIEVAL. THE DATA COLLECTION SYSTEM INCORPORATES STANDARDIZED ACCIDENT REPORTING FROM PARTICIPANT COMPANIES BASED ON A SPECIALLY DESIGNED FORM. A SYSTEM IS INCLUDED FOR RELATING VEHICLES REPORTED IN ACCIDENTS TO INDEPENDENT DATA SHEETS ON THE DESIGNS OF ALL VEHICLES OWNED BY PARTICIPANTS, THUS ENABLING ANALYSIS OF THE ROLE OF VEHICLE DESIGN IN ACCIDENTS. AT THE END OF TWO YEARS OF DATA COLLECTION IT IS ANTICIPATED THAT THERE WILL BE 8000 ACCIDENT REPORTS ON RECORD. OPERATORS PARTICIPATING IN THE DATA COLLECTION OWN APPROXIMATELY 60% OF ALL THE VEHICLES BELONGING TO COMPANIES PRIMARILY ENGAGED IN STAGE-CARRIAGE SERVICES IN THE UNITED KINGDOM AND EIRE, AND COVER ALL TYPES OF OPERATIONS FROM METROPOLITAN TO RURAL. PRELIMINARY ANALYSIS OF SOME 2200 REPORTS RECEIVED AND PROCESSED BY DEC 1976 SHOWED THE EFFECTIVENESS OF THE DATA CAPTURE SYSTEM. DETAILS OF BUS ACTION BEFORE THE ACCIDENT, INFORMATION ON THE ACTIONS AND LOCATIONS OF PASSENGERS, AND INJURIES RECEIVED BY ALL CASUALTIES ARE BEING REPORTED IN THE GREAT MAJORITY OF CASES. STUDIES IN PROGRESS USING DATA AVAILABLE TO DATE INCLUDE INVESTIGATION OF THE RELATIVE ACCIDENT RISKS ASSOCIATED WITH FRONT AND REAR ENTRANCE BUSES; AND THE INFLUENCE OF THE DIRECTION OF THE STAIRCASE ON DOUBLE DECK BUSES. OTHER STUDIES INCLUDE THE CHARACTERISTICS OF ACCIDENTS AT CENTER EXITS; COMPARISON OF ACCIDENT RISKS AS-



August 31, 1978

HS-022 546

SOCIATED WITH LOW FLOOR AND HIGH FLOOR BUSES; AND SOME ASPECTS OF ACCIDENTS INVOLVING EXTENSIVE DAMAGE TO THE PSV.

by M. A. JOHNSON  
MOTOR INDUSTRY RES. ASSOC., WALLING ST.,  
NUNEATON, WARWICK, ENGLAND  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-  
PUBLICATIONS-1977-6), "THE DESIGN,  
CONSTRUCTION, AND OPERATION OF PUBLIC  
SERVICE VEHICLES," LONDON, 1977 P153-63  
Rept. No. C170/77; 1977; 1REF  
PRESENTED AT A CONFERENCE SPONSORED BY  
INSTITUTION OF MECHANICAL ENGINEERS,  
AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE  
STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977.  
Availability: IN HS-022 527

HS-022 545

#### **POWER TRAIN ENGINEERING FOR PUBLIC SERVICE VEHICLES [BUSES]**

ALTERNATIVES IN PUBLIC SERVICE VEHICLE (PSV) (BUS) POWER TRAINS ARE REVIEWED BASED ON MAJOR REQUIREMENTS FORESEEN FOR THE 1980'S. TO ACCURATELY DETERMINE POWER TRAIN REQUIREMENTS, VARIOUS POWER LEVELS AND TORQUE CURVE SHAPES FOR OPTIMUM DRIVE CHARACTERISTICS MUST BE CONSIDERED WITHIN THE LIMITATIONS OF AVAILABLE POWER UNITS AND TRANSMISSIONS. TWO OF THE MAIN INSTALLATIONS OF POWER UNITS CURRENTLY USED ARE THE VERTICAL TRANSVERSE REAR ENGINE AND THE HORIZONTALLY MOUNTED UNDER FLOOR ENGINE. COMPARISONS OF ENGINES VARYING BETWEEN 8 AND 11 LITERS SHOW LITTLE DIFFERENCE IN PACKAGING REQUIREMENTS. ASSUMING THAT THE REMAINDER OF THE POWER TRAIN IS COMPATIBLE AND THAT RELIABILITY AND DURABILITY ARE ASSURED, ENGINE POWER, EXHAUST SMOKE, AND FUEL CONSUMPTION ARE MOST RELEVANT TO EVERYDAY OPERATION OF THE PSV. TWO DISTINCT PSV MARKETS EXIST REGARDING NOISE LEVELS REQUIRED BY VARIOUS CUSTOMERS: CUSTOMERS WHO ARE SATISFIED WITH VEHICLES MEETING LEGAL NOISE LEVELS AND THOSE WHO DEMAND A MUCH QUIETER VEHICLE. ALTERNATIVES EXIST WHICH CAN REDUCE ENGINE NOISE LEVELS, INCLUDING LOW NOISE COMBUSTION SYSTEMS AND RETARDED INJECTION TIMINGS. EXHAUST, FAN, AND OVERALL VEHICLE NOISE LEVELS ARE ALSO BEING EXAMINED IN TERMS OF ALTERNATIVE CONFIGURATIONS WHICH CAN MINIMIZE NOISE. COMPETITIVE PRESSURES INTERNATIONALLY ARE FORCING BRITISH ENGINE MANUFACTURERS TO MARKET ENGINES WHICH MINIMIZE INVISIBLE EXHAUST EMISSIONS, FOR EXAMPLE, BY USING ENGINE ASPIRATION. THE MATCHING OF VEHICLE TRANSMISSION-LINE COMPONENTS TO THE CHOSEN POWER UNIT INVOLVES NOT ONLY THE PROBLEM OF DEVELOPING INDIVIDUAL UNITS OF SPECIFIED PERFORMANCE AND RELIABILITY BUT IN PARTICULAR THE INTERACTION OF THE SEPARATE UNITS AND THEIR EFFECT ON TRANSMISSION EFFICIENCY AND DRIVEABILITY. PRACTICAL POWER DRIVE

SYSTEMS OFTEN INCLUDE EPICYCLIC GEARBOXES AND HYDRAULIC OPERATION TRANSMISSIONS.

by K. E. LEA; R. J. VARLEY  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-  
PUBLICATIONS-1977-6), "THE DESIGN,  
CONSTRUCTION, AND OPERATION OF PUBLIC  
SERVICE VEHICLES," LONDON, 1977 P165-72  
Rept. No. C222/77; 1977; 12REFS  
PRESENTED AT A CONFERENCE SPONSORED BY  
INSTITUTION OF MECHANICAL ENGINEERS,  
AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE  
STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977.  
Availability: IN HS-022 527

HS-022 546

#### **PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS] OCCUPANTS IN FRONTAL IMPACTS**

A DYNAMIC TEST TO EVALUATE OCCUPANT RETENTION BY COACH (BUS) SEATS IN SEVERE FRONTAL IMPACTS BASED ON IMPACT TESTING HAS BEEN DEVELOPED. BACKGROUND RESEARCH INDICATES THAT PASSENGER COMPARTMENTS OF COACHES REMAIN SUBSTANTIALLY INTACT IN MOST FRONTAL IMPACT ACCIDENTS, IMPLYING THAT INJURIES COULD BE REDUCED IF THE PASSENGERS WERE BETTER RESTRAINED IN THEIR SEATS. IN ORDER TO ASSESS THE PERFORMANCE REQUIRED OF COACH SEATS UNDER SEVERE CRASH CONDITIONS, THE TYPE OF SEAT FAILURES FOUND IN ACCIDENTS WERE REPRODUCED IN A TEST FACILITY. A SERIES OF SEATS WERE MOUNTED IN FRONT OF TWO SEATED ANTHROPOMORPHIC DUMMIES REPRESENTING 50TH PERCENTILE ADULT MALES ON THE IMPACT TROLLEY, USING A 10 G DECELERATION FROM 32 KM/H. THIS DYNAMIC TEST CAN BE USED TO CHECK THAT SEAT DESIGNS ARE SATISFACTORY IN THAT THE MOUNTING WILL REMAIN ATTACHED TO THE VEHICLE AND THE SEAT BACK WILL RETAIN THE OCCUPANT SEATED BEHIND IT. A STATIC TEST PROCEDURE MEASURES SEQUENTIAL LOADS APPLIED TO THE CENTER SEAT BACK AND THEN TO THE UPPER SEAT BACK. STATIC TESTS WOULD MEASURE FOR OCCUPANT RETENTION BUT NOT IMPACT PROTECTION. SEAT BELTS ARE BEING CONSIDERED AS AN ALTERNATIVE MEANS OF PASSENGER PROTECTION, PARTICULARLY FOR SEATS POSITIONED WITH NO SEAT IN FRONT OF THEM. IN ORDER TO INSTALL WORKABLE SEAT BELTS THE SEAT ITSELF AND ITS ANCHORAGE TO THE COACH WILL HAVE TO BE STRENGTHENED TO WITHSTAND ADDITIONAL LOAD.

by S. P. F. PETTY  
Publ: HS-022 527 (I-MECH-E-CONFERENCE-  
PUBLICATIONS-1977-6), "THE DESIGN,  
CONSTRUCTION, AND OPERATION OF PUBLIC  
SERVICE VEHICLES," LONDON, 1977 P173-6  
Rept. No. C236/77; 1977; 1REF  
PRESENTED AT A CONFERENCE SPONSORED BY  
INSTITUTION OF MECHANICAL ENGINEERS,  
AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE  
STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977.  
Availability: IN HS-022 527



HS-022 547

**THE 1980'S: CHALLENGES OF CHANGE  
CONFRONTING THE MOTOR VEHICLE AND  
FREEDOM OF MOBILITY**

THE U.S. MOTOR VEHICLE MANUFACTURING INDUSTRY'S POSITION IN MEETING THE CHALLENGE OF SAFETY AND ENVIRONMENTAL ISSUES IS STATED. THE VEHICLE MANUFACTURERS' RESPONSE TO THE PROBLEM OF AIR POLLUTION IS REFLECTED IN THE 1978 FLEET OF AUTOMOBILES WHICH EMIT 80%-90% LESS HYDROCARBONS AND CARBON MONOXIDE AND ABOUT 60% LESS NITROGEN OXIDES THAN UNCONTROLLED PRE-1968 CARS. WITH RESPECT TO VISUAL POLLUTION, THE VEHICLE MANUFACTURERS AND THEIR SUPPLIERS TRY TO MINIMIZE SCRAP AND MAXIMIZE SALVAGE (NEARLY 90% OF OBSOLETE CARS ARE RECYCLED FOR THEIR IRON AND STEEL, AND 95% OF THE METAL IN THE VEHICLES BEING PROCESSED IS RECOVERED). IN SPITE OF TECHNOLOGICAL CONFLICTS BETWEEN EMISSION CONTROLS AND FUEL ECONOMY, AMERICAN VEHICLE MANUFACTURERS HAVE MADE MEANINGFUL ACHIEVEMENTS IN REDUCING THE FUEL CONSUMPTION OF CARS AND TRUCKS. AUTOMOBILE FUEL ECONOMY HAS IMPROVED 34% IN THE PAST THREE YEARS AS MANUFACTURERS HAVE SCALED DOWN FULL-SIZED CARS AND INTRODUCED NEW CLASSES OF MID-RANGE AND SMALL CARS. IN 1976, NEW, MORE FUEL-ECONOMICAL VEHICLES PURCHASED BY TRUCKING FIRMS ENABLED OPERATORS TO SAVE 155 MILLION GALLONS OF FUEL. WITH RESPECT TO HIGHWAY SAFETY, NUMEROUS SAFETY IMPROVEMENTS IN VEHICLES AND USE OF PASSENGER RESTRAINT SYSTEMS HAVE CONTRIBUTED TO THE IMPRESSIVE DECLINE IN TRAFFIC FATALITIES DURING THE PAST DECADE. IT IS FELT THAT THESE ACHIEVEMENTS REFLECT A "CAN-DO" ATTITUDE THAT HAS HISTORICALLY MARKED THE MOTOR VEHICLE INDUSTRY IN AMERICA. IT IS FELT THAT INDUSTRY AND GOVERNMENT MUST ENTER THE 1980'S DETERMINED TO WORK TOGETHER TO BALANCE THE SOCIAL, ECONOMIC AND TRANSPORTATION NEEDS OF AMERICA FAIRLY AND EQUITABLY. THE FOLLOWING CRITERIA ARE RECOMMENDED TO ASSURE THAT GOVERNMENTAL ACTIONS ARE CONSTRUCTIVE: EXISTENCE OF A PROVEN NEED FOR ACTION ON THE BASIS OF PUBLIC HEALTH AND WELFARE; ESTABLISHMENT OF PRIORITIES AMONG INTERRELATED AND OFTEN CONFLICTING GOALS; CAREFUL ANALYSIS OF THE COSTS, BENEFITS, RISKS OF THE KNOWN METHODS (VEHICLE AND NONVEHICLE) OF DEALING WITH THE PROBLEM WITHIN THE PRESENT STATE OF TECHNICAL KNOWLEDGE; PRIMARY RELIANCE ON THE PRICE MECHANISM IN THE MARKETPLACE TO RESOLVE THOSE SOCIETAL CONCERNS SUCH AS REDUCTION IN FUEL CONSUMPTION; WHERE THE MARKETPLACE WILL NOT FUNCTION ADEQUATELY TO RESOLVE PROBLEMS, USE OF MEANINGFUL PRE-RULEMAKING DIALOGUE AMONG GOVERNMENT AGENCIES AND AMONG GOVERNMENT, INDUSTRY AND CONSUMERS; AND BETTER EDUCATION OF THE PUBLIC BY GOVERNMENT AND INDUSTRY ON CITIZEN RESPONSIBILITY IN RESOURCE CONSERVATION, ENVIRONMENTAL PROTECTION, AND PUBLIC

SAFETY RELATED TO THE OWNERSHIP AND OPERATION OF MOTOR VEHICLES.

by V. J. ADDUCI  
MOTOR VEHICLE MANUFACTURERS ASSOC. OF THE  
UNITED STATES, INC.

1977; 8P

PRESENTED AT 8TH WORLD MEETING OF THE  
INTERNATIONAL ROAD FEDERATION, TOKYO, 17  
OCT 1977.

Availability: CORPORATE AUTHOR

HS-022 548

**ENERGY USE AND OTHER COMPARISONS  
BETWEEN DIESEL AND GASOLINE PICKUP  
TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977**

A SIX-MONTH STUDY WAS UNDERTAKEN TO DETERMINE FUEL ECONOMY, COST ECONOMY AND RELIABILITY DIFFERENCES, IF ANY, BETWEEN GASOLINE AND DIESEL ENGINES USED IN LIGHT-DUTY PICKUP TRUCKS. BASED ON TOTAL MILES AND TOTAL GALLONS FOR A FIVE-MONTH PERIOD, THE MILES PER GALLON (MPG) FOR 14 DIESEL UNITS WAS FOUND TO BE 20.73 AND THE MPG FOR 14 GASOLINE UNITS WAS FOUND TO BE 15.08. BASED ON THESE TWO CONSUMPTION RATES, THE DIESEL UNITS WERE FOUND TO PROVIDE APPROXIMATELY 37% MORE MPG THAN THEIR GASOLINE COUNTERPARTS. THE DIESEL-POWERED TRUCK THAT HAD DRIVEN THE MOST MILES (43,800) AVERAGED 19.70 MPG; THE GASOLINE-POWERED TRUCK THAT HAD DRIVEN THE MOST MILES (23,394) AVERAGED 16.69 MPG. IT WAS THOUGHT THAT THE DIESEL PICKUPS WERE GETTING MOISTURE IN THE FUEL TANK WHICH WAS CAUSING THE ENGINES TO DIE OUT, AND THUS, APPROXIMATELY 100 GALLONS OF FUEL WERE DUMPED. IF THIS FUEL HAD NOT BEEN DUMPED, THE OVERALL MPG WOULD HAVE INCREASED TO APPROXIMATELY 20.91. THE AVERAGE ENGINE OIL REQUIRED FOR THE DIESEL UNITS WAS FOUND TO BE 12.30 QUARTS PER 3000 MILES; THE AVERAGE ENGINE OIL USED FOR THE GASOLINE UNITS WAS FOUND TO BE 5.71 QUARTS PER 3000 MILES. THUS, THE ENGINE OIL REQUIRED FOR THE DIESEL PICKUPS WAS 115% MORE THAN FOR THE GASOLINE PICKUPS. FUEL, LUBRICANTS, PARTS, AND LABOR COSTS PER MILE WERE FOUND TO BE APPROXIMATELY 4 3/4 CENTS PER MILE FOR THE GASOLINE-POWERED VEHICLES AND 3 3/4 PER MILE FOR THE DIESEL PICKUPS. THE MOST COMMON REMARK OF DRIVERS INTERVIEWED WAS THAT THE UNITS SHOULD HAVE HAD POWER STEERING. GENERALLY SPEAKING, THE ONLY PROBLEMS THE DRIVERS FOUND WERE WITH THE FUEL LINE AND THE FUEL FILTER OF THE DIESEL TRUCKS, WHICH WERE NOT PROPERLY DESIGNED FOR THE SUBZERO WEATHER EXPERIENCED DURING THE STUDY. THE CAPITAL COST DIFFERENCE BETWEEN THE DIESEL AND GASOLINE PICKUPS WAS \$1928.70. THE GASOLINE PICKUPS COST \$4628.19 EACH, THE DIESELS, \$6556.89.

by KENNETH M. JACOBS  
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SQUARE, CAMBRIDGE, MASS. 02142; STATE OF MAINE

August 31, 1978

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DEPT. OF TRANSPORTATION, MATERIAL AND RES.  
DIV., BOX 1208, HOGAN RD., BANGOR, MAINE 04401  
DOT-TSC-1299  
Rept. No. DOT-TSC-OST-77-6; 1978; 25P  
Availability: NTIS

HS-022 549

### **HIGH DRIVING [DRUNK DRIVING]**

THE EFFECT OF ALCOHOL ON HUMAN METABOLISM IS DISCUSSED IN RELATIONSHIP TO DRIVING. ALCOHOL IS A DRUG, AND ITS OVERALL EFFECT IS DEPRESSION, NOT STIMULATION. THE AMOUNT OF ALCOHOL IN A PERSON'S SYSTEM IS MEASURED IN MG OF ALCOHOL PER ML OF BLOOD WHICH IS KNOWN AS THE BAL (BLOOD ALCOHOL LEVEL). MOST LAW ENFORCEMENT AGENCIES IN THE U.S. CONSIDER A DRIVER TO BE IMPAIRED WITH A 0.05 TO 0.09 BAL AND INTOXICATED WITH A 0.10 BAL. A PERSON CAN BURN UP ABOUT 0.02 BAL PER HOUR WHICH IS EQUAL TO ABOUT ONE DRINK (12 OUNCES OF 4% BEER, FIVE OUNCES OF 12% WINE, OR ONE AND A HALF OUNCES OF HARD LIQUOR) PER HOUR BASED ON A 150-POUND MAN'S NORMAL METABOLIC RATE. IT IS STRESSED THAT HOW YOU FEEL IN RELATION TO DRINKING HAS LITTLE TO DO WITH HOW YOU CAN DRIVE. A NEW BREATH TESTER FOR MEASURING DRIVER ALCOHOL LEVELS CALLED A.L.E.R.T. (ALCOHOL LEVEL EVALUATION ROADSIDE TESTER), MODEL J3AD, IS DESCRIBED. TESTS ARE DESCRIBED WHICH WERE CONDUCTED TO ANALYZE THE DRIVING BEHAVIOR AND TO MEASURE BAL'S USING THE J3AD OF THREE DRIVERS WHO VOLUNTEERED TO NEGOTIATE A 675-FOOT SLALOM PYLON COURSE FOR SEVERAL RUNS WHILE CONSUMING ALCOHOLIC BEVERAGES AS THEY WENT ALONG. TEST RESULTS AND COMMENTS BY THE DRINKING DRIVERS ON HOW THEY FELT DURING THE TEST AND COMMENTS BY OBSERVERS ON HOW THE DRIVERS BEHAVED ARE PRESENTED FOR EACH INDIVIDUAL.

by STEVE THOMPSON

Publ: CAR AND DRIVER V23 N9 P57-8, 61, 65, 67-8 (MAR 1978)

Availability: SEE PUBLICATION

HS-022 550

### **EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING ISSUES, TECHNIQUES, AND THEIR RELATIONSHIPS**

THE RESULTS OF THE WORK PERFORMED DURING PHASE 1 OF THE NATIONAL COOPERATIVE HWY. RES. PROG. (NCHRP) PROG. 8-18 ENTITLED "TECHNIQUES FOR EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING" ARE REPORTED. THE RESEARCH OBJECTIVE IS TO PROVIDE TRANSPORTATION PLANNING METHODOLOGIES THAT WILL BE POLICY-SENSITIVE AND THAT WILL FACILITATE THE TESTING AND EVALUATION OF OPTIONS IN A MANNER THAT WILL PRODUCE RESULTS TIMELY FOR DECISION MAKING.

IN PHASE 1, THE MAJOR TRANSPORTATION ISSUES AND THEIR INFORMATION NEEDS WERE IDENTIFIED. TECHNIQUES AVAILABLE TO ADDRESS THESE INFORMATION NEEDS WERE ALSO IDENTIFIED AND EVALUATED. STUDY DESIGNS WERE DEVELOPED TO TEST THE HIGH-PRIORITY TECHNIQUES IN SELECTED STATES WITH THE AID OF PROCEDURAL MANUALS TO BE DEVELOPED DURING PHASE 2 OF THIS STUDY. A TWO-PRONGED APPROACH WAS TAKEN TO IDENTIFY MAJOR STATE-LEVEL ISSUES AND THE TECHNIQUES NECESSARY TO RESOLVE THEM. AN EXTENSIVE BODY OF LITERATURE WAS REVIEWED. THE KNOWLEDGE GAINED FROM THIS SOURCE WAS THEN SUPPLEMENTED BY FIELD INTERVIEWS WITH THOSE PERSONS CURRENTLY ACTIVE IN STATEWIDE TRANSPORTATION AND PROGRAMMING. THE BASIC PRODUCTS OBTAINED THROUGH THIS APPROACH INCLUDE THE FOLLOWING: AN ANNOTATED BIBLIOGRAPHY OF ALL REVIEWED LITERATURE; A LIST OF APPROXIMATELY 75 SPECIFIC MAJOR ISSUES, A DESCRIPTION OF 144 TECHNIQUES FOR PROVIDING INFORMATION TO ADDRESS THESE ISSUES, RANGING FROM OPERATIONAL TECHNIQUES THAT HAVE BEEN APPLIED IN ONE OR MORE STATES TO TECHNIQUES FROM THE LITERATURE THAT HAVE NOT YET BEEN FIELD TESTED; AND A LIST OF GENERALLY AVAILABLE DATA ITEMS AND THEIR SOURCES. THE LIST OF ISSUES WAS SORTED INTO THE FOLLOWING 11 MAJOR ISSUE AREAS WITHIN WHICH STATES MAKE KEY TRANSPORTATION DECISIONS: REVENUE SHORTFALL; DEVELOPMENT OF MULTIMODAL TRANSPORTATION POLICIES, PLANS, AND PROGRAMS; ORGANIZATION AND MANAGEMENT; COORDINATION WITH OTHER STATE AND REGIONAL PROGRAMS; DEVELOPMENT OF ENERGY POLICY, PLAN, AND PROGRAM; RELATIONSHIP BETWEEN TRANSPORTATION IMPROVEMENTS AND DEVELOPMENTS; MAJOR CORRIDOR IMPROVEMENTS; COST EFFECTIVENESS IN HIGHWAY STANDARDS AND MAINTENANCE; IMPROVEMENT/ABANDONMENT OF RAIL SERVICE; FUNDING OF TRANSIT SERVICES AND IMPROVEMENTS; AND AIRPORT CAPITAL IMPROVEMENTS. THE INFORMATION JUDGED TO BE MOST IMPORTANT IN ADDRESSING THE MAJOR ISSUE AREAS WAS GROUPED INTO THE FOLLOWING SEVEN FIELDS OF IMPACT: ENVIRONMENTAL, SOCIAL, ECONOMIC, TRAVEL, DEVELOPMENT, LEGAL/ADMINISTRATIVE/INSTITUTIONAL/FINANCIAL, AND PLAN AND PROGRAM EVALUATION. THE SAME FIELDS OF IMPACT WERE USED TO CLASSIFY TECHNIQUES SO THAT THE IDENTIFIED INFORMATION NEEDS COULD BE READILY RELATED TO THE AVAILABLE TECHNIQUES.

by SALVATORE J. BELLOMO; JAWAHARLAL J. MEHRA; JOSEPH R. STOWERS; HARRY S. COHEN; MICHAEL R. PETERSILIA; ARLEE T. RENO  
PLANNING ENVIRONMENT INTERNATIONAL,  
MCLEAN, VA.; SYSTEM DESIGN CONCEPTS, INC.,  
WASHINGTON, D.C.

Rept. No. NCHRP-179; 1977; 101P 165REFS  
SPONSORED BY AMERICAN ASSOC. OF STATE HWY.  
AND TRANSPORTATION OFFICIALS IN COOPERATION  
WITH THE FEDERAL HWY. ADMINISTRATION.

Availability: TRB \$5.60

HS-022 552

HSL 78-08

HS-022 552

### **DESIGN INNOVATIONS FACILITATING ECONOMIC PRODUCTION OF GIANT MOULDINGS**

THE PHILOSOPHY BEHIND TECHNICAL DEVELOPMENTS TO FACILITATE THE ECONOMIC PRODUCTION OF GIANT INJECTION MOLDS IS THE BELIEF IN THE NEED TO RAISE THE STANDARD OF THE INJECTION MOLDING MACHINE TO MEET THE MOLDER'S ECONOMIC NEEDS FOR EFFICIENT MACHINE LOADING, LOW REJECT RATES, AND FLASH-FREE MOLDING. A DESCRIPTION IS GIVEN OF THE PROGRESS MADE IN THE DEVELOPMENT OF HYDRAULIC CIRCUITRY, VALVE GEAR, AND ELECTRONIC CONTROLS, TO PROVIDE THE GREATER ACCURACY NEEDED FOR FINE SETTING OF THE INJECTION AND CLAMPING UNITS. IT IS SHOWN HOW THE DESIGN OF THE CIRCUITRY PERMITS THE USE OF MORE THAN ONE CLAMPING UNIT OR INJECTION UNIT IN PARALLEL TO ECONOMICALLY PRODUCE MOLDINGS OF VERY LARGE PROJECTED AREAS. AN UP-TO-DATE METHOD OF DEVOLATIZING THERMOPLASTIC MATERIALS DURING PLASTICIZING, WITHOUT PRE-DRYING, WHICH IS A CONTRIBUTION TO BOTH ECONOMICS AND QUALITY IS ALSO DESCRIBED.

by H. STRASSHEIMER  
GKN WINDSOR G.M.B.H.

Rept. No. SAE-770233; 1977; 15P  
PRESENTED AT INTERNATIONAL AUTOMOTIVE CONGRESS AND EXPOSITION, DETROIT, 28 FEB-4 MAR 1977.

Availability: SAE

HS-022 553

### **THE 1979 ESTIMATE OF THE COST OF COMPLETING THE INTERSTATE SYSTEM. INSTRUCTION MANUAL FOR PREPARATION AND SUBMISSION**

THIS MANUAL IS FOR USE BY INDIVIDUAL STATES TO PREPARE ESTIMATES FOR APPORTIONMENT OF FUNDS FOR THE FEDERAL-AID INTERSTATE SYSTEM ACCORDING TO TITLE 23, USC, SECTION 104(B)(5), AS AMENDED. CHAPTERS CONCERN GENERAL INFORMATION AND CONTROLS OF THE HIGHWAY SYSTEM, TRAFFIC ESTIMATES, DESIGN DETAILS, ROUTE DESIGNATION AND DESCRIPTION, ESTIMATE SECTIONS AND DESIGN DATA, COST ESTIMATE FOR ESTIMATE SECTIONS, AND THE NATIONAL SUMMARY REPORT. APPENDICES CONCERN DATA PROCESSING FOR THE 1979 ESTIMATE AND DEVELOPMENT OF RIGHT-OF-WAY AND RELOCATION COSTS.

FEDERAL HWY. ADMINISTRATION, WASHINGTON, D.C. 20590

1978; 144P REFS

Availability: CORPORATE AUTHOR

HS-022 554

### **TRANSPORTATION FOR ELDERLY AND HANDICAPPED PERSONS**

LEGISLATION CONCERNING TRANSPORTATION FOR THE ELDERLY AND THE HANDICAPPED IS UNCLEAR AS TO WHETHER TOTAL ACCESSIBILITY OR SIMPLY IMPROVED MOBILITY IS REQUIRED. A CONCEPT OF TRANSPORTATION-HANDICAPPED PERSONS HAS BEEN DEVELOPED TO HELP RESOLVE THE CONTROVERSIAL DEFINITION OF USER GROUPS. TYPES OF SERVICES AVAILABLE FOR THE ELDERLY AND THE HANDICAPPED INCLUDE THE FOLLOWING: FIXED ROUTE AND SCHEDULE; MODIFIED FIXED ROUTE AND SCHEDULE WITH DEVIATION FROM FIXED ROUTE; FARE REDUCTION PROGRAMS; DIAL-A-RIDE; AND VOLUNTEER SERVICES. AS FOR EQUIPMENT, THERE IS A DIVERSITY OF SMALL BUSES AND VANS READILY AVAILABLE BUT LACKING THE BENEFIT OF INTERCHANGEABILITY; DEVELOPMENT OF WHEELCHAIR LIFTS FOR EXISTING FLEETS HAS NOT BEEN SUCCESSFUL. THE DIVERSITY OF FUNDING SOURCES HAS LED TO PROBLEMS OF LIMITED COVERAGE AND SOME COMPETITION BETWEEN PROGRAMS. CONTRACTS AND CURRENT PROGRAMS ARE DESCRIBED, AND AN ANNOTATED BIBLIOGRAPHY IS INCLUDED.

URBAN CONSORTIUM FOR TECHNOLOGY INITIATIVES, TRANSPORTATION TASK FORCE; PUBLIC TECHNOLOGY, INC., 1140 CONNECTICUT AVE., N.W., WASHINGTON, D.C. 20036  
1976; 32P 30REFS

SUPPORTED BY DEPT. OF TRANSPORTATION.  
Availability: DEPARTMENT OF TRANSPORTATION

HS-022 555

### **NEW STANDARD BUS EQUIPMENT**

THE HARDWARE ASPECTS OF DEVELOPING IMPROVED BUSES FOR PUBLIC TRANSIT ARE CONSIDERED, ESPECIALLY THE LOW-FLOOR VERSUS HIGH-FLOOR CONCEPTS AND THE BIG BUS VERSUS LITTLE BUS CONCEPTS. THE HISTORY OF MOTOR BUS SERVICE SINCE 1965 IS REVIEWED, AND DATA CONCERNING VARIOUS TYPES OF BUSES ARE CHARTED. THE LOW-FLOOR TYPE OF BUS HAS INCREASED SPEED IN LOADING AND UNLOADING, IMPROVED PASSENGER AND VEHICLE SAFETY, AND THE ABILITY TO PROVIDE A RAMP RATHER THAN A LIFT FOR WHEELCHAIR ACCESS. IT IS MORE EXPENSIVE THAN CURRENT HIGH-FLOOR VEHICLES, HOWEVER, MAY HAVE GROUND CLEARANCE PROBLEMS, AND WOULD REQUIRE NEW EQUIPMENT PACKAGING AND FABRICATION TECHNIQUES. THE URBAN MASS TRANSPORTATION ADMINISTRATION ISSUED A POLICY STATEMENT IN JUN 1976 NOT IN FAVOR OF THE LOW-FLOOR BUS. QUESTIONS OF COSTS AND BENEFITS AND OF STANDARDIZATION ARE CONSIDERED, AS ARE THE ISSUES OF INNOVATION AND COMPETITION. CONTRACTS AND CURRENT PROGRAMS ARE DESCRIBED, AND AN ANNOTATED BIBLIOGRAPHY IS INCLUDED.

URBAN CONSORTIUM FOR TECHNOLOGY INITIATIVES, TRANSPORTATION TASK FORCE;

PUBLIC TECHNOLOGY, INC., 1140 CONNECTICUT AVE., N.W., WASHINGTON, D.C. 20036  
1976; 33P 12REFS  
SUPPORTED BY DEPT. OF TRANSPORTATION.  
Availability: DEPARTMENT OF TRANSPORTATION

HS-022 556

### TRAFFIC SIGNALIZATION SYSTEMS

EXISTING TRAFFIC SIGNALIZATION SYSTEMS, SELECTION OF SUCH SYSTEMS, AND THEIR EVALUATION AND COST ARE CONSIDERED. SIGNALIZATION SYSTEMS ARE EITHER ELECTROMECHANICAL OR COMPUTER CONTROLLED. QUESTIONS TO CONSIDER IN EVALUATING A SYSTEM INCLUDE THE FOLLOWING: HOW A BASELINE SYSTEM CAN BE DEFINED RELATIVE TO ITS POTENTIAL FOR IMPROVEMENT, HOW MUCH OF AN ECONOMIC OR OTHER IMPROVEMENT CAN BE EXPECTED OVER EXISTING OPERATIONS, AND HOW THE SYSTEM IS IMPLEMENTED. CONTRACTS AND CURRENT PROGRAMS ARE DESCRIBED, AND AN ANNOTATED BIBLIOGRAPHY IS PRESENTED.

URBAN CONSORTIUM FOR TECHNOLOGY INITIATIVES, TRANSPORTATION TASK FORCE; PUBLIC TECHNOLOGY, INC., 1140 CONNECTICUT AVE., N.W., WASHINGTON, D.C. 20036  
1976; 28P 16REFS  
SUPPORTED BY DEPT. OF TRANSPORTATION.  
Availability: DEPARTMENT OF TRANSPORTATION

HS-022 557

### AUTOMOTIVE APPLICATIONS OF SENSORS

EIGHT PAPERS PRESENT AN OVERVIEW OF AUTOMOTIVE ENGINE CONTROL SENSOR TECHNOLOGY, WITH SPECIAL REFERENCE TO THE WIEGAND EFFECT AND PRECISION POSITION SENSORS. APPLICATIONS OF SENSORS TO ENGINE CONTROL ARE DISCUSSED, ESPECIALLY TEMPERATURE SENSING. A ZIRCONIA-BASED LEAN AIR/FUEL RATIO SENSOR IS DESCRIBED, AS WELL AS APPLICATION OF A CRANKSHAFT POSITION SENSOR TO CONTROL ENGINE TIMING. ALSO DESCRIBED IS THE FIRST AUTOMOTIVE CAPACITIVE PRESSURE SENSOR.

SOCIETY OF AUTOMOTIVE ENGINEERS, 400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096  
Rept. No. SP-427; 1978; 74P REFS  
PRESENTED AT SAE CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978. INCLUDES HS-022 558--HS-022 565.  
Availability: SAE

HS-022 558

### A WORLDWIDE OVERVIEW OF AUTOMOTIVE ENGINE CONTROL SENSOR TECHNOLOGY

AN OVERVIEW IS PRESENTED OF DEVELOPMENTS ON THE PRINCIPAL SENSORS APPLICABLE TO AUTOMOTIVE ENGINE CONTROL THROUGH BRIEF DESCRIPTIONS OF THE MORE IMPORTANT SENSOR CONCEPTS FOR THE VARIOUS PARAMETERS, AND

AN INDICATION OF SENSOR STATUS. THE PARAMETERS COVERED ARE MANIFOLD ABSOLUTE PRESSURE, MANIFOLD VACUUM, AMBIENT ABSOLUTE PRESSURE, CRANKSHAFT POSITION (SPEED), MASS AIR FLOW, FUEL FLOW, COOLANT TEMPERATURE, AIR TEMPERATURE, OXYGEN PARTIAL PRESSURE, AND THROTTLE POSITION. AN ATTACHED BIBLIOGRAPHY CITES RESEARCH LEADING TO FUTURE ENGINE-CONTROL PARAMETERS, SUCH AS CARBON DIOXIDE AND OXIDES OF NITROGEN PARTIAL PRESSURES, AMBIENT HUMIDITY, EXHAUST-GAS FLOW, AND CATALYST TEMPERATURE. TORQUE, KNOCK, AND ENGINE ROUGHNESS FACTORS MAY ALSO BE SENSOR-CONTROLLED. RELEVANT ACTIVITIES IN PROVIDING SENSOR STANDARDS ARE DESCRIBED, SUCH AS THE EFFORTS OF THE SAE ELECTRONIC STANDARDS COM. AND OF THE INTERNATIONAL STANDARDS ORGANIZATION.

by WILLIAM G. WOLBER  
BENDIX RES. LAB., SOUTHFIELD, MICH.  
Publ: HS-022 557 (SP-427), "AUTOMOTIVE APPLICATIONS OF SENSORS," WARRENDALE, PA., 1978 P1-18  
Rept. No. SAE-780207; 1978; 64REFS  
PRESENTED AT SAE CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: IN HS-022 557

HS-022 559

### THE WIEGAND EFFECT AND ITS AUTOMOTIVE APPLICATIONS

THE WIEGAND EFFECT IS EXPLAINED AS A NEW MAGNETIC PHENOMENON OCCURRING IN A SPECIALLY WORK-HARDENED, SMALL-DIAMETER, FERROMAGNETIC WIRE. WHEN SUBJECTED TO AN APPROPRIATE MAGNETIC FIELD, A SUDDEN, VERY RAPID FLUX CHANGE OCCURS. A SUBSTANTIAL VOLTAGE PULSE MAY BE INDUCED IN A SENSING COIL WOUND AROUND THE WIEGAND WIRE, OR IN ITS PROXIMITY. NO ELECTRICAL INPUT IS REQUIRED, AND WITH THE APPROPRIATE EXCITATION THE PULSE IS ESSENTIALLY INDEPENDENT OF THE RATE OF FLUX CHANGE OF THE EXTERNALLY APPLIED FIELD. AMONG THE USEFUL ENGINEERING PARAMETERS OF THE WIEGAND EFFECT ARE A LOW LOAD RESISTANCE AND TEMPERATURE CHARACTERISTICS SUITABLE FOR HOSTILE ENVIRONMENTS. DEVELOPMENT HAS BEGUN ON USE OF THE WIEGAND WIRE AS AN IGNITION TRIPPER IN AN AUTOMOBILE DISTRIBUTOR. OTHER APPLICATIONS ARE ENVISIONED, SUCH AS A SOURCE OF SPEED SIGNALS FOR A SPEEDOMETER OR TACHOMETER, A SPEED AND POSITION TRANSDUCER FOR A CRANKSHAFT, A FLOWMETER, A WHEEL SENSOR FOR ANTISKID SYSTEMS, AND A TRANSMISSION CONTROL SIGNAL.

by J. DAVID MARKS; MICHAEL J. SINKO  
ECHLIN MFG. CO.  
Publ: HS-022 557 (SP-427), "AUTOMOTIVE APPLICATIONS OF SENSORS," WARRENDALE, PA., 1978 P19-24  
Rept. No. SAE-780208; 1978; 5REFS  
PRESENTED AT SAE CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: IN HS-022 557

HS-022 560

HSL 78-08

HS-022 560

### **PRECISION POSITION-SENSORS IN AUTOMOTIVE APPLICATIONS**

THE BASICS OF PRECISION POTENTIOMETERS AND SWITCHES ARE DESCRIBED. THESE INSTRUMENTS HAVE BEEN ADAPTED FOR SPECIALIZED ENGINE APPLICATIONS IN RESPONSE TO THE NEED FOR A VARIETY OF PRECISION POSITION-SENSORS CAPABLE OF RELIABLE PERFORMANCE IN UNDERHOOD ENVIRONMENTS AND WERE DEVELOPED FOR USE IN ELECTRONIC FUEL INJECTION (EFI) AND ELECTRONIC FUEL MANAGEMENT (EFM) SYSTEMS. WIREWOUND AND NONWIREWOUND RESISTIVE ELEMENTS ARE DESCRIBED, INCLUDING THOSE OF CARBON COMPOSITION, CERMET, AND CONDUCTIVE PLASTIC, AS WELL AS OF RESISTOFILM. AMONG THE AVAILABLE NONLINEAR OUTPUT FUNCTIONS ARE SINUSOIDAL OUTPUTS, MODIFIED TANGENTS, SECANTS, AND EMPIRICAL FUNCTIONS, AS WELL AS A PRESSURE-ALTITUDE FUNCTION FOR BAROMETRIC SENSORS. THESE ELEMENTS MAY BE PACKAGED TO PROVIDE SUCH ENGINE APPLICATIONS AS THROTTLE POSITION SENSING AND EXHAUST-GAS RECIRCULATION. USE OF LOW-COST MATERIALS AND NEW DESIGN CONCEPTS HAS MADE THESE PRECISION SENSORS ECONOMICALLY FEASIBLE FOR LARGE AUTOMOBILE PRODUCTION VOLUMES. POSSIBLE FUTURE APPLICATIONS INCLUDE BRAKESHOE, CRANKSHAFT, AND ANTENNA POSITION.

by WILLIAM WHEELER  
NEW ENGLAND INSTRUMENT CO., RES. AND DEVEL.  
DEPT., NATICK, MASS.  
Publ: HS-022 557 (SP-427), "AUTOMOTIVE APPLICATIONS OF SENSORS," WARRENDALE, PA., 1978 P25-33  
Rept. No. SAE-780209; 1978; 4REFS  
PRESENTED AT SAE CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: IN HS-022 557

HS-022 561

### **APPLICATION OF AUTOMOTIVE SENSORS TO ENGINE CONTROL**

THE APPLICATION OF AUTOMOTIVE SENSORS TO ELECTRONIC CONTROL OF THE INTERNAL-COMBUSTION ENGINE IS PRESENTED, WITH EMPHASIS ON SENSOR-SIGNAL CHARACTERISTICS AND UTILIZATION. MANIFOLD ABSOLUTE PRESSURE, CRANKSHAFT POSITION, THROTTLE POSITION, TEMPERATURE, AND EXHAUST-GAS RECIRCULATION ARE AMONG THE PARAMETERS MONITORED TO ELECTRONICALLY REGULATE ENGINE INPUTS. THE MOST ADVANCED EXHAUST-GAS SENSORS UNDER DEVELOPMENT ARE MADE OF ZIRCONIUM DIOXIDE AND TITANIUM DIOXIDE. ALSO PRESENTED ARE A

NUMBER OF CONTROL CONCEPTS REALIZED BY THESE SENSORS.

by J. N. REDDY  
BENDIX ELECTRONICS AND CONTROL SYSTEMS GROUP, TROY, MICH.  
Publ: HS-022 557 (SP-427), "AUTOMOTIVE APPLICATIONS OF SENSORS," WARRENDALE, PA., 1978 P35-41  
Rept. No. SAE-780210; 1978; 7REFS  
PRESENTED AT SAE CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: IN HS-022 557

HS-022 562

### **TEMPERATURE SENSORS FOR ELECTRONIC ENGINE CONTROL SYSTEMS**

TEMPERATURE SENSORS ARE DESCRIBED WHICH WERE DEVELOPED FOR ELECTRONIC ENGINE CONTROL TO MEET INCREASING EMISSION AND FUEL ECONOMY REQUIREMENTS. THE SENSORS ACCURATELY ASSESS ENGINE COOLANT AND INLET AIR TEMPERATURES IN ORDER TO CONTROL EXHAUST GAS RECIRCULATION FLOW AND SPARK TIMING. THE SENSORS ARE QUICK-RESPONDING, DURABLE, RELIABLE, AND CAPABLE OF ENDURING THE VEHICLE ENGINE COMPARTMENT ENVIRONMENT. THE MANUFACTURING STEPS ARE RELATIVELY SIMPLE AND SUSCEPTIBLE TO GOOD QUALITY CONTROL. AMONG THE QUALITY TESTS PERFORMED ARE VERIFICATION OF THE PROPER VOLTAGE RATIO VERSUS TEMPERATURE RESPONSE, A SELF-HEATING TEST, THERMAL TIME CONSTANT TESTS, AND DURABILITY TESTING FOR RESISTANCE TO SALT SPRAY, VIBRATION, AND SHOCK. AN ACCELERATED LIFE TEST IS ALSO INCLUDED, CONSISTING OF 20,000 TEMPERATURE CYCLES.

by JAMES E. ACKER  
FORD MOTOR CO., ELECTRICAL AND ELECTRONICS DIV.  
Publ: HS-022 557 (SP-427), "AUTOMOTIVE APPLICATIONS OF SENSORS," WARRENDALE, PA., 1978 P43-6  
Rept. No. SAE-780211; 1978  
PRESENTED AT SAE CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: IN HS-022 557

HS-022 563

### **A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR**

AN EXPERIMENTAL SENSOR IS DESCRIBED, WHICH INDICATES THE AIR/FUEL RATIO OF AN ENGINE OPERATING ON LEAN MIXTURES. STABILIZED ZIRCONIA DOPED WITH IRON WAS USED AS THE SENSOR ELECTROLYTE. THESE SENSORS ARE INTERNALLY TEMPERATURE COMPENSATED, ELIMINATING THE NEED FOR ADDITIONAL TEMPERATURE SENSING OR ELECTRONICS. SENSOR OUTPUT IS RESPONSIVE TO EXHAUST OXYGEN CONTENT, BUT IS INDEPENDENT OF EXHAUST TEMPERATURES

August 31, 1978

HS-022 566

ABOVE 450° C AT 18:1. ADDITION OF IRON INCREASED UNIFORMITY OF OUTPUT AMONG SENSORS.

by DAVID S. HOWARTH; RALPH V. WILHELM, JR.  
GENERAL MOTORS CORP., RES. LAB.  
Publ: HS-022 557 (SP-427), "AUTOMOTIVE APPLICATIONS OF SENSORS," WARRENDALE, PA., 1978 P47-52  
Rept. No. SAE-780212; 1978; 17REFS  
PRESENTED AT SAE CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: IN HS-022 557

HS-022 564

### **APPLICATION OF A CRANKSHAFT POSITION SENSOR TO CONTROL ENGINE TIMING**

THE CRANKSHAFT POSITION SENSOR (CPS) IS DESCRIBED AS A VARIABLE RELUCTANCE MAGNETIC SENSOR WHICH ACCURATELY SENSES THE POSITION OF FOUR TEETH EQUALLY SPACED 90° APART ON A TOOTHED RING ATTACHED TO THE CRANKSHAFT. THE ELECTRONIC ENGINE CONTROL (EEC) CALCULATES RPM USING TWO ADJACENT PULSES, AND WITH OTHER PROCESSED INFORMATION, CALCULATES SPARK ADVANCE. ACTUAL SPARK INITIATION AGAIN USES THE CPS AS A REFERENCE POSITION. RAW DATA FOR THE VARIOUS SENSORS, CIRCUITS, HOLDERS, AND WHEELS ARE TABULATED. UTILIZING DEVELOPED MODELS AND EXPERIMENTAL DATA, FORMULAS WERE ESTABLISHED TO CONTROL THE SURFACE NOISE GENERATED BY THE WHEEL, AND TO CONTROL THE GAP VARIATION. IT WAS FOUND THAT THE PULSE DETECTION CIRCUIT CAN BE CONTROLLED WITH A MINIMAL ANGULAR ERROR IN POSITION SENSING FOR WHICH THE SYSTEM CAN BE CALIBRATED.

by J. C. COOK, 2ND  
FORD MOTOR CO.  
Publ: HS-022 557 (SP-427), "AUTOMOTIVE APPLICATIONS OF SENSORS," WARRENDALE, PA., 1978 P53-64  
Rept. No. SAE-780213; 1978  
PRESENTED AT SAE CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: IN HS-022 557

HS-022 565

### **THE FIRST PRODUCTION AUTOMOTIVE CAPACITIVE PRESSURE SENSOR**

A CAPACITIVE PRESSURE SENSOR USED IN THE 1978 LINCOLN VERSAILLES IS DESCRIBED, WHICH IS FOUND TO BE COMPATIBLE WITH THE AUTOMOTIVE ENVIRONMENT. THE DESIGN REQUIRES THE USE OF ONLY ONE MOVING PART TO PRODUCE A VOLTAGE OUTPUT PROPORTIONAL TO THE INPUT PRESSURE SIGNAL. AMONG THE BASIC FEATURES OF THE SENSOR IS ADAPTABILITY TO HIGH-VOLUME PRODUCTION METHODS. THE MATERIALS USED HAVE PRECISION TOLERANCE LEVELS FOR THERMAL EXPANSION, THEY ARE FREE FROM MECHANICAL AND THERMAL HYSTERESIS, AND THEY DO NOT EXHIBIT MEASURABLE DETERIORATION OR CHANGE IN CHARACTERISTICS WITH TIME AND TEMPERATURE.

THE SENSOR HAS A LOW VOLUMETRIC DISPLACEMENT (.0005 CU IN), AND THUS HAS A HIGH FREQUENCY RESPONSE. RESULTS ARE PRESENTED OF TESTS FOR REPEATABILITY AND HYSTERESIS, AND FOR DESIGN VALIDATION, AS WELL AS RESULTS OF VEHICLE AND LABORATORY TESTING. THE RESPONSE OF THIS PRESSURE SENSOR IS FOUND TO BE OF THE "FIRST ORDER" (NONOSCILLATORY). THE INSTRUMENT PROVIDES HIGH DURABILITY AND REPEATABILITY AT A MODEST PRODUCT COST.

by GARY M. MARX; ROBERT L. BELL  
FORD MOTOR CO., ALLEN PARK, MICH.; KAVLICO CORP., CHATSWORTH, CALIF.  
Publ: HS-022 557 (SP-427), "AUTOMOTIVE APPLICATIONS OF SENSORS," WARRENDALE, PA., 1978 P65-71  
Rept. No. SAE-780214; 1978; 3REFS  
PRESENTED AT SAE CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: IN HS-022 557

HS-022 566

### **BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976**

THIRTY-SIX ARTICLES COVER VARIOUS ASPECTS OF VEHICLE BRAKING SYSTEM PERFORMANCE AND DEFECTS, INCLUDING BASIC FACTORS INFLUENCING THIS PERFORMANCE, BRAKING SYSTEMS FOR RIGID AND NONRIGID VEHICLES, STABILITY OF ROAD VEHICLE TRAINS AND MOTORCYCLES, AND THE DYNAMICS OF WHEEL BRAKING AND WHEEL SLIP CONTROL. TIRE/ROAD INTERFACE IS DISCUSSED, AS WELL AS TRACTION MEASUREMENT AND EVALUATION OF PASSENGER CAR BRAKING PERFORMANCE. THE PRACTICAL ASPECTS OF TESTING ANTILOCK SYSTEM PERFORMANCE, AND COMPUTER ANALYSIS OF SUCH PERFORMANCE ARE INCLUDED. EXISTING BRAKE DESIGN AND NEW DEVELOPMENTS ARE DISCUSSED, AS WELL AS NEW DYNAMOMETER TESTS. BRAKE SQUEAL IS CONSIDERED IN DISC AND DRUM SYSTEMS. THE INFLUENCE OF DRIVER BEHAVIOR ON ACCIDENT INVOLVEMENT IS ALSO CONSIDERED, AS ARE MAINTENANCE, REPAIR, EFFECTIVENESS, AND RELIABILITY REQUIREMENTS, INCLUDING LEGISLATIVE CONTROL. COMMERCIAL VEHICLE BRAKES ARE CONSIDERED SEPARATELY IN SOME ARTICLES.

INSTITUTION OF MECHANICAL ENGINEERS (I MECH E), LONDON, ENGLAND  
Rept. No. I-MECH-E-CONFERENCE-PUBLICATIONS-1976-5; 1977; 384P REFS  
INCLUDES HS-022 567--HS-022 602.  
Availability: MECHANICAL ENGINEERING PUBLICATIONS, P.O. BOX 24, BURY ST. EDMUNDS, SUFFOLK IP32 6BW, ENGLAND

HS-022 567

HSL 78-08

HS-022 567

### **BASIC PRINCIPLES [VEHICLE BRAKING]**

THE MAIN FACTORS INVOLVED IN DECELERATING A VEHICLE INCLUDE ROAD/TIRE ADHESION, STEADY STATE AND TRANSIENT LOAD TRANSFERS, AND THE COMPLICATIONS RESULTING FROM THE MANY TYPES OF VEHICLES AND THEIR LOADINGS. METHODS FOR IMPROVING STABILITY INCLUDE LOAD-SENSING PROPORTIONING VALVES, ANTILOCK DEVICES, HAND AND FOOT BRAKING CONTROLS, AND HYDRAULIC AND DIRECT AIR-ACTUATING SYSTEMS. BRAKE MECHANISMS AND THE PARTS PLAYED BY THE BRAKE COMPONENTS ARE DISCUSSED. DISC BRAKES ARE MORE STABLE THAN DRUM BRAKES AND CAN RUN AT HIGHER TEMPERATURES. ON HEAVY VEHICLES, HOWEVER, DRUM BRAKES HAVE THE ADVANTAGE.

by T. P. NEWCOMB  
LOUGHBOROUGH UNIV. OF TECHNOLOGY, LEICS.,  
ENGLAND  
Publ: HS-022 566 (I-MECH-E-CONFERENCE-  
PUBLICATIONS-1976-5), "BRAKING OF ROAD  
VEHICLES," LONDON, 1977 P1-9  
Rept. No. C22/76; 1977; 14REFS  
PRESENTED AT INSTITUTION OF MECHANICAL  
ENGINEERS CONFERENCE, LOUGHBOROUGH,  
LEICS., 23-25 MAR 1976.  
Availability: IN HS-022 566

HS-022 568

### **BRAKING SYSTEMS FOR RIGID VEHICLES**

THE CONSIDERATIONS INVOLVED IN SELECTING A BRAKING SYSTEM FOR A RIGID VEHICLE INCLUDE RELIABILITY WITH MINIMUM MAINTENANCE, ACCEPTABLE PEDAL EFFORT AND TRAVEL, AND EFFECTIVE STOPPING CAPABILITY. MOTOR VEHICLE LEGISLATION IS ALSO A FACTOR IN BRAKE SELECTION. ADJUSTMENT OF A FIXED BRAKE RATIO BETWEEN FRONT AND REAR WHEELS REQUIRES COMPROMISES. SYSTEM PRESSURES ARE MODULATED WITH VALVES FOR OPTIMUM PERFORMANCE. SELECTION OF WHEEL BRAKES IS AFFECTED BY VEHICLE WEIGHT AND ENGINE POWER, AND BY TYPE OF TERRAIN OVER WHICH THE VEHICLE IS DRIVEN, LONG HILL DESCENTS BEING PARTICULARLY DEMANDING ON BRAKING SYSTEMS. THE PERFORMANCE OF DISC BRAKES (OPPOSED PISTON AND SINGLE SIDED), AND VARIOUS TYPES OF DRUM BRAKES IS COMPARED, INCLUDING THE RELATIONSHIP BETWEEN INPUT FORCE AND TRAVEL ('PV' ANALYSIS), AND FADE SENSITIVITY. VARIOUS ACTUATION MEDIA ARE DISCUSSED, SUCH AS VACUUM, AIR, HYDRAULIC, AND COMBINATION. IT IS RECOMMENDED THAT A VEHICLE DATA SHEET BE USED BY THE BRAKE MANUFACTURER TO ASSEMBLE THE SPECIFICATIONS INVOLVED IN THE COMPROMISE OF BRAKE SELECTION AND ADJUSTMENT, INCLUDING SUCH DATA AS A 'PV' ANALYSIS, AN ENERGY ABSORBING ANALYSIS, AND CHOICE OF APPORTIONING VALVE. EMPHASIS IS PLACED ON

THE SIGNIFICANCE OF THE AREA OF BRAKING SURFACE WHICH IS RUBBED BY THE BRAKE LINING.

by B. INGRAM; D. PEASLEY  
GIRLING, LTD., KINGS RD., TYSELEY, BIRMINGHAM,  
ENGLAND  
Publ: HS-022 566 (I-MECH-E-CONFERENCE-  
PUBLICATIONS-1976-5), "BRAKING OF ROAD  
VEHICLES," LONDON, 1977 P11-24  
Rept. No. C49/76; 1977; 4REFS  
PRESENTED AT INSTITUTION OF MECHANICAL  
ENGINEERS CONFERENCE, LOUGHBOROUGH,  
LEICS., 23-25 MAR 1976.  
Availability: IN HS-022 566

HS-022 569

### **NON-RIGID VEHICLE BRAKING SYSTEMS**

THE PROBLEMS OF PROVIDING A BRAKING SYSTEM FOR A NONRIGID VEHICLE INCLUDE ARTICULATION OF THE VEHICLE, THE SEPARATION OF THE PRIME MOVER FROM THE TOWED VEHICLE, AND INTERCHANGEABILITY BETWEEN THE TOWING AND TOWED VEHICLES. THIS INTERCHANGEABILITY INVOLVES COMPATIBILITY OF BRAKE PERFORMANCE FOR SAFE OPERATION. BRAKING REQUIREMENTS FOR A NONRIGID VEHICLE OR COMBINATION OF VEHICLES MUST ALLOW FOR RELATIVE ARTICULATION IN YAW AND PITCH, FOR SAFE BRAKING OF THE POWERED VEHICLE WITHOUT TOW, AND FOR SIMPLE DISCONNECTION AND RECONNECTION OF BRAKE POWER LINES BETWEEN VEHICLES. VARIOUS BRAKING SYSTEMS INCLUDE INERTIA (OVER-RUN), MECHANICAL, VACUUM, AND AIR PRESSURE SYSTEMS. RELAY EMERGENCY VALVES ARE DESCRIBED FOR AUTOMATICALLY APPLYING TRAILER BRAKES UPON DETACHMENT FROM THE PRIME MOVER. ON HEAVY COMMERCIAL VEHICLES, AIR PRESSURE BRAKING SYSTEMS HAVE ALMOST COMPLETELY DISPLACED VACUUM SYSTEMS. FULL POWER HYDRAULIC SYSTEMS, USING ACCUMULATOR ENERGY STORAGE AND CLOSED-CENTER VALVE CONTROL UNITS, ARE BEING USED ON RIGID VEHICLES, BUT CREATE A PROBLEM IN INTERCHANGEABILITY BETWEEN TRUCK AND TRAILER UNITS. A COMBINED HYDRAULIC PUMP/AIR COMPRESSOR UNIT CAN BE USED TO ACHIEVE COMPATIBILITY, OR A HYDRAULIC PUMP CAN BE MOUNTED ON A TRAILER.

by B. R. SHILTON  
CLAYTON DEWANDRE CO. LTD., LINCOLN,  
ENGLAND  
Publ: HS-022 566 (I-MECH-E-CONFERENCE-  
PUBLICATIONS-1976-5), "BRAKING OF ROAD  
VEHICLES," LONDON, 1977 P25-33  
Rept. No. C26/76; 1977  
PRESENTED AT INSTITUTION OF MECHANICAL  
ENGINEERS CONFERENCE, LOUGHBOROUGH,  
LEICS., 23-25 MAR 1976.  
Availability: IN HS-022 566



August 31, 1978

HS-022 573

HS-022 570

### **LATERAL STABILITY OF COMMERCIAL ROAD VEHICLE TRAINS UNDER BRAKING CONDITIONS**

ROAD TRAINS ARE DEFINED AS A TRACTOR PLUS AN ARBITRARY NUMBER OF TRAILERS. COMMERCIAL ROAD VEHICLE TRAINS ARE DEFINED AS TWO TYPES; TRUCK PLUS FULL TRAILER(S) AND TRACTOR PLUS SEMITRAILER PLUS FULL TRAILER(S). A RANGE OF SIX ROAD TRAINS, WITH ONE, TWO, AND THREE LOAD UNITS FOR EACH TYPE ARE SPECIFIED. THE EQUATIONS OF LATERAL MOTION WHILE BRAKING FOR A GENERALIZED ROAD TRAIN ARE OUTLINED AND A METHOD OF LINEARIZING THEM PROPOSED SO THAT EIGEN VALUES MAY BE OBTAINED TO PROVIDE DATA ON THE DYNAMICAL CHARACTERISTICS. THE EQUATIONS ARE SOLVED FOR THE SIX LADEN ROAD TRAINS, UNBRAKED, BRAKED WITHOUT AXLE LOCKING, WITH SINGLE AXLE LOCKING, AND WITH TWO AXLES LOCKING, AND THE RESULTS ANALYZED AND DISCUSSED. THERE ARE STRONG SIMILARITIES BETWEEN THE TWO TYPES OF ROAD TRAIN. THE MAJOR DETERIORATIONS IN LATERAL STABILITY ARE ASSOCIATED WITH LOCKING OF THE SECOND AND THIRD AXLES OF ANY ROAD TRAIN.

by F. D. HALES

LOUGHBOROUGH UNIV. OF TECHNOLOGY,  
LOUGHBOROUGH, LEICS., ENGLAND

Publ: HS-022 566 (I-MECH-E-CONFERENCE-  
PUBLICATIONS-1976-5), "BRAKING OF ROAD  
VEHICLES," LONDON, 1977 P35-44

Rept. No. C23/76; 1977; 9REFS

PRESENTED AT INSTITUTION OF MECHANICAL  
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### **THE STABILITY OF MOTORCYCLES IN ACCELERATION AND DECELERATION**

THE EFFECTS OF ACCELERATING AND BRAKING ON THE STABILITY CHARACTERISTICS OF A MOTORCYCLE AND RIDER ARE CALCULATED THROUGH A MODIFICATION OF A PREVIOUSLY PUBLISHED ANALYSIS. THE INDIVIDUAL INFLUENCES ARE ENUMERATED AND THEIR CONTRIBUTION CONSIDERED. IT IS CONCLUDED THAT ACCELERATION HAS A SIGNIFICANT STABILIZING INFLUENCE ON THE CAPSIZE MODE AND THAT DECELERATION HAS THE OPPOSITE EFFECT. IN SOME CIRCUMSTANCES, ACCELERATION CAN PRODUCE A LARGE REDUCTION IN WEAVE MODE DAMPING AND A CORRESPONDING INCREASE IN WOBBLE MODE DAMPING, SO THAT THE TWO MODES LOSE THEIR IDENTITY. AMONG THE DESIGN FEATURES WHICH SEPARATE THE WEAVE AND WOBBLE MODE FREQUENCIES ARE LOW STEERING INERTIA, HIGH TRAIL, AND HIGH VALUES FOR THE FRONT TIRE CORNERING STIFFNESS (CF1) AND SELF ALIGNING MOMENT TO SIDESLIP ANGLE CONSTANT (CF3). SEPARATION OF THE TWO MODES WILL PREVENT CONFUSION OF

THE MODES AND ITS UNDESIRABLE CONSEQUENCES.

by R. S. SHARP

UNIVERSITY OF LEEDS, ENGLAND

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### **THE DYNAMICS OF WHEEL BRAKING**

IN AN ANALYSIS OF THE DYNAMIC BEHAVIOR OF A WHEEL DURING TRANSIENT BRAKE APPLICATION, EMPHASIS IS PLACED ON THE USE OF SIMPLE COMPUTER MODELS TO PRESENT FUNDAMENTAL DATA OF IMPORTANCE TO BRAKE SYSTEM DESIGN. DYNAMIC WEIGHT UPON THE WHEEL, RATE OF BRAKE APPLICATION, THE BRAKE FORCE SLIP DIAGRAM SHAPE, AND THE GEAR ENGAGED ARE SHOWN TO HAVE A SIGNIFICANT INFLUENCE ON WHEEL MOTION. THE USE OF BRAKE PRESSURE AS AN INDICATION OF EFFECTIVE BRAKE TORQUE IS SHOWN TO BE MISLEADING, IT BEING POSSIBLE TO DEVELOP VERY HIGH STRUCTURAL BRAKE TORQUES ON SLIPPERY SURFACES. WHEEL DECELERATION IN ISOLATION IS DEMONSTRATED TO BE AN INADEQUATE PARAMETER TO DEFINE SKID CORRECTIVE ACTION. THE EFFECT OF COMBINED STEERING AND BRAKING, SUSPENSION COMPLIANCE, AND WEIGHT TRANSFER ARE DISCUSSED. IT IS CONCLUDED THAT THE ANALOGUE PRESENTATION OF SIMPLE CASES IS USEFUL IN CONVEYING FUNDAMENTAL PRINCIPLES TO DESIGN AND DEVELOPMENT ENGINEERS AS AN AID TO CREATIVE DESIGN AND PROBLEM DIAGNOSIS.

by M. B. PACKER

AUTOMOTIVE PRODUCTS LTD., LEAMINGTON SPA,  
ENGLAND

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### **THE INFLUENCE OF WHEEL SLIP CONTROL DYNAMICS ON VEHICLE STABILITY DURING BRAKING AND STEERING**

IN AN EXTENSION AND CONTINUATION OF WORK PERFORMED WITHIN THE SWEDISH EXPERIMENTAL SAFETY VEHICLE PROJECT, "STEERABILITY DURING EMERGENCY BRAKING," A MATHEMATICAL WHEEL MODEL IS PRESENTED, BASED ON DYNAMIC TIRE AND VEHICLE TESTS ON ICE AND ON ASPHALT. WHEEL LOCKING PROPERTIES ARE STUDIED IN



HYBRID SIMULATIONS DURING PANIC MANEUVERS WITH SPECIAL CONSIDERATION OF WHEEL STABILITY. DIFFERENT PRINCIPLES OF ANTISKID SYSTEMS ARE SIMULATED AND GENERAL REQUIREMENTS ON WHEEL LOCKING BEHAVIOR FOR VEHICLE STABILITY ARE FORMULATED. PRINCIPAL PARTS AND PHENOMENA INCLUDED IN THE MATHEMATICAL FORMULA ARE SPRUNG MASS, SUSPENSION LINKS, WHEEL MOVEMENTS, STEERING GEAR, TIRE FORCES, AND ANTILOCK SYSTEM. THE WAY TIRE FORCES DEPEND ON THE WHEEL LOAD HAS A GREAT INFLUENCE ON VEHICLE STABILITY, AS DEMONSTRATED WITH STUDDED TIRES ON ICE. SKID PADS FOR TESTING VEHICLES SHOULD BE USED WITH CARE, AS BEHAVIOR MAY VARY FROM THAT OF REAL WORLD CONDITIONS. THE USE OF "FRICTION NUMBER" IS NOT ENOUGH TO CHARACTERIZE A TIRE/ROAD COMBINATION WHEN STUDYING VEHICLE STABILITY. ANTILOCK SYSTEMS MUST BE WELL ADAPTED TO THE VEHICLE IN ORDER TO ENSURE STABILITY. UNDER REAL CONDITIONS, THE MEAN SLIP LEVELS SHOULD BE CONTROLLED TO ABOUT 20% AT THE FRONT WHEELS AND 10%-15% AT THE REAR, PROVIDING GOOD STEERABILITY AND GOOD BRAKEABILITY.

by E. ELGESKOG; S. BRODD  
AB VOLVO, TECHNOLOGICAL DEVEL. DEPT.,  
GOTHENBURG, SWEDEN  
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HS-022 574

#### **THE TYRE/ROAD [TIRE/ROAD] INTERFACE--ITS EFFECT ON BRAKING**

RECENT ADVANCES IN THE UNDERSTANDING OF THE RESPECTIVE PARTS PLAYED BY THE ROAD SURFACE AND TIRE IN THE INTERFACE PROBLEM ARE CRITICALLY REVIEWED, FEATURING THE ROLES OF TIRE TREAD PATTERN, TREAD COMPOUND FORMULATION, ROAD SURFACE, AND VEHICLE SPEED, AS WELL AS THEORIES OF RUBBER FRICTION. ROAD ACCIDENT STATISTICS UNDER WET CONDITIONS CONFIRM THE NEED FOR FURTHER IMPROVEMENTS IN THE VEHICLE FRICTIONAL CHARACTERISTICS DESPITE ADVANCES MADE IN ROAD SURFACE, TIRE AND BRAKE TECHNOLOGY OVER RECENT YEARS. THE REQUIRED OVERALL PERFORMANCE IS DEPENDENT ON THE ABILITY OF THE TIRE TO CREATE ADEQUATE FRICTION AT THE INTERFACE WITH THE ROAD SURFACE; THIS IS DETERMINED TO A LARGE EXTENT BY THE CHARACTERISTICS OF THE ROAD SURFACE AND VEHICLE BRAKES. THE VARIABLES OF ROAD SURFACE TYPE AND CONDITION, TIRE CONSTRUCTION AND TREAD COMPOUND COMPOSITION, AND SOME ASPECTS OF BRAKE PERFORMANCE WERE STUDIED AND RELATED TO THE PERFORMANCE OF THE VEHICLE UNDER BRAKING AND CORNERING MANEUVERS. SOME RESULTS OF THE PRACTICAL APPLICATION OF THE STUDY OF

ROAD SURFACES WITH PARTICULAR EMPHASIS ON TIRE-TO-ROAD INTERACTION ARE GIVEN TO SUPPORT RESEARCH INTO THE REQUIRED GEOMETRY OF ROAD SURFACE TEXTURE FOR OPTIMUM WET SKIDDING RESISTANCE AND MINIMUM TIRE-TO-ROAD NOISE GENERATION. IN CONCLUSION, A REVIEW IS PRESENTED OF LEGISLATION INVOLVING THE WET FRICTIONAL PERFORMANCE OF BOTH TIRES AND ROADS.

by A. R. WILLIAMS; R. BOND; J. H. PENNELLS  
DUNLOP LTD., BIRMINGHAM, ENGLAND  
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#### **WET FRICTION--TYRE [TIRE] AND ROAD [BRAKING]**

THE FACTORS AFFECTING WET ROAD FRICTION ARE CONSIDERED, SINCE THIS CONDITION IS ONE OF THE LIMITING PARAMETERS IN BRAKING PERFORMANCE. THE NEED FOR DRAINAGE IN BOTH THE TIRE AND ROAD SURFACE BECOMES MORE IMPORTANT WITH INCREASING SPEED, AND OF THE TWO, THE ROAD SURFACE CAN BE MOST EFFECTIVE AT PROVIDING ADEQUATE DRAINAGE AND HENCE IMPROVED GRIP. TIRE TREAD MATERIALS ALSO INFLUENCE THE LEVEL OF WET ROAD SKID-RESISTANCE AND CONTRIBUTE TO IMPROVED BRAKING, TRACTION, AND CORNERING CHARACTERISTICS OF VEHICLES. COMMERCIAL VEHICLE TIRES IN GENERAL USE TREAD MATERIALS WHICH ARE MORE RESILIENT THAN THOSE USED FOR CAR TIRES, THEY ALSO HAVE LESS EFFECTIVE TREAD DRAINAGE, AND BOTH FEATURES, POLYMER AND DRAINAGE ARE DETERMINED TO SOME EXTENT BY THE PROBLEMS OF HEATING AND LOADING. TESTS ON SIMPLE STRAIGHT GROOVED TRUCK TIRE PATTERNS SUGGEST THAT THE RATIO OF THE GROOVE TO RIB WIDTH IS LESS IMPORTANT THAN AN EFFECTIVE DISTRIBUTION OF GROOVES ACROSS THE WIDTH OF A TIRE. ADEQUATE LEVELS OF WET ROAD SKID-RESISTANCE ARE PROVIDED BY THE CORRECT PROPERTIES AT THE INTERFACE WITH THE TIRE. ROAD SURFACE WEARING COURSES WHEN NEW PROVIDE THESE PROPERTIES, BUT REGULAR MONITORING OF BOTH SKID-RESISTANCE AND TEXTURE DEPTH IS NEEDED TO ESTABLISH

August 31, 1978

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WHEN ROUTINE MAINTENANCE SHOULD BE CARRIED OUT.

by T. WILLIAMS

DEPARTMENT OF THE ENVIRONMENT, TRANSPORT AND ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND

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### MEASUREMENTS OF THE LONGITUDINAL AND LATERAL TRACTION PROPERTIES OF TRUCK TIRES

A MOBILE APPARATUS HAS BEEN DEVELOPED TO PERMIT MEASUREMENT OF THE LONGITUDINAL AND LATERAL SHEAR FORCE BEHAVIOR OF COMMERCIAL VEHICLE TIRES ON ACTUAL PAVED SURFACES. THE APPARATUS IS DISCUSSED AND DATA ARE PRESENTED DESCRIBING VARIOUS TRACTION PROPERTIES OF TRUCK TIRES. DATA RELEVANT TO HEAVY TRUCK BRAKING COVER THE LONGITUDINAL FORCE RESPONSE TO LONGITUDINAL SLIP, AS INFLUENCED BY VELOCITY, TIRE LOAD, AND PAVEMENT SELECTION. DATA RELEVANT TO CORNERING COVER THE SIDE FORCE RESPONSE TO ANGULAR SLIP, AS INFLUENCED BY VELOCITY AND VERTICAL LOAD. NEW TRUCK TIRES (WITH SUCH SURFACE CONTAMINATION AS IS COMMON AFTER FINAL MANUFACTURE) DELIVER A LONGITUDINAL TRACTION PERFORMANCE ON THEIR FIRST LOCKUP CYCLE WHICH IS STATISTICALLY INDISTINGUISHABLE FROM PERFORMANCE IN LATER TEST CYCLES UP TO ABOUT 25% LOSS OF TREAD DEPTH. AS FOR LATERAL TEST MEASUREMENTS, THERE IS A SIGNIFICANT CHANGE IN BEHAVIOR WITH THE ACCRUAL OF TEST-INDUCED WEAR. IT IS NOTED THAT THESE INVESTIGATIONS WERE LIMITED TO DRY SURFACES.

by R. D. ERVIN

UNIVERSITY OF MICHIGAN, HWY. SAFETY RES. LAB., ANN ARBOR, MICH.

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### EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS

ALL NECESSARY RELATIONS AND DEDUCTIONS FOR ESTABLISHING A BRAKE-FORCE DIAGRAM ARE PRESENTED, TO EVALUATE THE BRAKING PERFORMANCE OF A MOTOR VEHICLE. THE BRAKE-FORCE DISTRIBUTION DIAGRAM IS USED TO CLARIFY THE ADVANTAGES AND SHORTCOMINGS OF "KINKED" BRAKE-FORCE DISTRIBUTION OF A BRAKE-PRESSURE DEPENDENT CHANGE-OVER POINT IN CONTRAST TO THE FIXED DISTRIBUTION TYPE. IT WAS FOUND THAT HIGHER UTILIZATION OF FRICTION IN THE "KINKED" SYSTEM IS OCCASIONALLY A SERIOUS DISADVANTAGE RATHER THAN AN ADVANTAGE. BRAKE-FORCE PROPORTIONING DEVICES ARE NOT SAFE METHODS FOR PREVENTING THE LOCKING OF REAR AXLES; RATING A BRAKE SYSTEM ONLY ON THE FACTORS VALID FOR STRAIGHTFORWARD STOPS IS NOT DEFENSIBLE.

by M. BURCKHARDT; E. C. GLASNER VON OSTENWALL

DAIMLER-BENZ AG, TEST DEPT., STUTTGART, WEST GERMANY

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### COMPUTER ANALYSIS OF ANTILOCK SYSTEM PERFORMANCE IN THE BRAKING OF COMMERCIAL VEHICLES

THE USE OF COMPUTER SIMULATION TO ANALYZE THE BRAKING PERFORMANCE OF COMMERCIAL VEHICLES EQUIPPED WITH ANTILOCK SYSTEMS IS EXAMINED, AND A TECHNIQUE DELINEATED FOR MEASURING THE PRESSURE MODULATION CHARACTERISTICS OF ANTILOCK SYSTEMS. A SUBPROGRAM FOR SYNTHESIZING ANTILOCK SYSTEM PERFORMANCE WITHIN THE FRAMEWORK OF A LARGE-SCALE DIGITAL COMPUTER SIMULATION OF THE BRAKING OF TRUCKS AND TRACTOR-SEMITRAILER VEHICLES IS DESCRIBED. COMPARISONS BETWEEN MEASURED AND CALCULATED VEHICLE PERFORMANCE ARE MADE TO INDICATE THE VALIDITY OF THE COMPUTERIZED ANALYSIS. FINDINGS CONCERNING THE SENSITIVITY OF THE BRAKING PERFORMANCE OF A TRUCK TO TIRE, BRAKE, SUSPENSION, AND ANTILOCK PROPERTIES ARE TABULATED AND DISCUSSED. THE COMPUTER SIMULATION IS PRESENTED AS A DESIGN ANALYSIS TOOL TO ASSESS THE INFLUENCE OF DESIGN CHANGES, COMPONENT VARIATIONS, OR VEHICLE CONDITION ON THE BRAKING PERFORMANCE OF A GIVEN TYPE OF VEHICLE: IN THIS CASE, A NEW TRUCK EQUIPPED WITH AN ANTILOCK SYSTEM IN COMPLIANCE WITH

FEDERAL MOTOR VEHICLE SAFETY STANDARD (FMVSS) 121. THE RESULTS MAY NOT BE EXTRAPOLATED TO OTHER VEHICLE TYPES OR OTHER ANTILOCK SYSTEMS.

by P. S. FANCHER; C. C. MACADAM  
UNIVERSITY OF MICHIGAN, HWY. SAFETY RES.  
INST., ANN ARBOR, MICH.  
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### **PRACTICAL ASPECTS OF TESTING ANTI-LOCK SYSTEMS ON COMMERCIAL VEHICLES**

THE ENVIRONMENT, PROCEDURES, AND RESULTS OF TESTS ON ANTILOCK SYSTEMS FITTED TO COMMERCIAL VEHICLES ARE DESCRIBED. THE OBJECT OF THE TEST PROCEDURE IS TO TEST THE SYSTEMS' CAPABILITY TO FUNCTION ON VARIOUS ROAD SURFACES, TO MAINTAIN VEHICLE STABILITY AND MANEUVERABILITY, TO RETAIN ADEQUATE ENERGY RESOURCE TO PROVIDE SUSTAINED BRAKING, AND TO MEET CURRENT AND PROPOSED LEGISLATION. THE MAIN TEST CATEGORIES INCLUDE STATIC TESTS, HILL HOLDING TESTS, AND BRAKING ON VARIOUS FRICTION SURFACES (CONSTANT, SPLIT, AND TRANSITIONAL). LANE CHANGE MANEUVERS WERE ACCOMPLISHED FOR STEERABILITY, RADIO INTERFERENCE WAS CHECKED, AND AN ELECTRONIC CIRCUIT TEST WAS MADE ON PAVE SURFACE. EUROPEAN AND U.S. BRAKING REQUIREMENTS ARE SUMMARIZED. TESTS FOR ENERGY CONSUMPTION AND ADHESION UTILIZATION ARE DISCUSSED, AND TEST RESULTS REPORTED FROM AN AIR/HYDRAULIC ACTUATION SYSTEM AND A FULL AIR BRAKE SYSTEM. RESULTS OF DEVELOPMENT TESTS ON LEYLAND TRACTORS AND TWO TYPES OF TRAILER ARE REPORTED, INCLUDING FAILURE SIMULATION AND DIFFERENT LOADING MODES (TRACTOR ALONE, TRACTOR AND UNLADEN TRAILER, AND TRACTOR AND LADEN TRAILER). CURRENT ANTILOCK SYSTEMS CAN PROVIDE AN IMPROVEMENT IN STABILITY FOR ARTICULATED VEHICLES ON ALL ROAD SURFACES WITH ONLY A MARGINAL INCREASE IN STOPPING DISTANCE ON HIGH MUE SURFACES.

by W. J. P. ADAMS; D. R. SPENCE  
GIRLING LTD., KINGS RD., TYSELEY, BIRMINGHAM  
B11 2AH, ENGLAND  
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### **SOME SIGNIFICANT DEVELOPMENTS IN AIR BRAKE SYSTEM COMPONENTS**

THE DEVELOPMENT OF AIR BRAKE EQUIPMENT IS REVIEWED, STEMMING FROM THE 1869 PATENT OF GEORGE WESTINGHOUSE. AUTOMOTIVE AIR BRAKES AND DUAL BRAKE SYSTEMS ARE DESCRIBED. HIGHER GROSS WEIGHTS PERMITTED ON TRUCKS LED TO INDEPENDENT SECONDARY BRAKE SYSTEMS. REGULATIONS ON PARKING PERFORMANCE OF TRUCKS INFLUENCED THE USE OF THE SPRING BRAKE AND THE LOCK ACTUATOR. DEVELOPMENT OF REMOTE CONTROL PARKING BRAKE ACTUATORS LED TO THE DEVELOPMENT OF HAND-OPERATED AIR CONTROL VALVES. VARIABLE LOAD VALVES WERE DEVELOPED IN RESPONSE TO REQUIREMENTS FOR REGULATING BRAKE FORCE IN ACCORDANCE WITH WEIGHT DISTRIBUTION. A RECENT DEVELOPMENT IS AN ELECTRONIC BRAKING CORRECTOR, WHICH IS SEEN AS A STEP TOWARD MORE COMPREHENSIVE ANTISKID SYSTEMS. ANOTHER INNOVATION IS AN AIR DRYER FOR REDUCING MAINTENANCE IN AIR BRAKE SYSTEMS. PRESENT AIR BRAKE COMPONENTS ARE CHARACTERIZED BY INCREASED SUBSTITUTION OF DIE-CAST ALLOYS AND PLASTICS IN PLACE OF IRON AND BRASS FOR CORROSION RESISTANCE, EASE OF MANUFACTURE, AND REDUCED WEIGHT. INCLUDED IN THESE COMPONENTS ARE SPECIAL VALVES REQUIRED BY THE EEC (EUROPEAN ECONOMIC COMMUNITY) DIRECTIVE. IT IS RECOMMENDED THAT SIMPLE, ROBUST, AND RELIABLE DESIGN OF AIR BRAKE SYSTEMS BE GIVEN A HIGH PRIORITY BY DESIGNERS, AND THAT COMPLEX SYSTEMS OF UNPROVEN EFFECTIVENESS NOT BE ADOPTED.

by G. BURRIDGE  
BENDIX WESTINGHOUSE LTD., KINGSWOOD,  
BRISTOL, ENGLAND  
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### **CAST IRON BRAKE ROTOR METALLURGY**

CONSIDERABLE DIFFERENCES OCCURRING IN THE DURABILITY AND FRICTION CHARACTERISTICS OF APPARENTLY IDENTICAL BRAKE ASSEMBLIES ARE SHOWN TO BE DUE TO DIFFERENCES IN THE AMOUNT OF TITANIUM IN THE CAST IRON BRAKE ROTORS. INVESTIGATION OF THE MECHANISM BY WHICH TITANIUM INCREASES DURABILITY SHOWS THAT OTHER ELEMENTS SUCH AS VANADIUM AND NIOBIUM ARE ALSO EFFECTIVE, SINCE THEY ALSO PRODUCE VERY SMALL HARD CARBIDE PARTICLES IN THE CAST IRON. ABILITY TO CONTROL THE CONCENTRATION OF THESE ELEMENTS IN FOUNDRIES USING THE CUPOLA METHOD AND IN THOSE WITH INDUCTION HEATED FURNACES IS DEMONSTRATED.

IT IS RECOMMENDED THAT THE METALLURGY OF CAST IRON BE CONTROLLED THROUGHOUT FOR INCREASED DURABILITY OF BRAKE DRUMS AS WELL AS BRAKE DISCS, AND FOR MORE CONSISTENCY IN VEHICLE PERFORMANCE. COLLABORATION IS RECOMMENDED BETWEEN BRAKE ROTOR MANUFACTURERS AND PRODUCERS OF FRICTION LININGS.

by B. J. CHAPMAN; D. HATCH  
FERODO LTD., CHAPEL-EN-LE-FRITH, DERBY,  
ENGLAND  
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### BRAKES--A REVIEW OF EXISTING DESIGN

THE DESIGN OF AUTOMATIC DISC BRAKE CALIPERS AND OF DRUM BRAKES IS SHOWN TO RESULT FROM THE INTERACTION OF FUNCTIONAL REQUIREMENTS WITH GOVERNMENTAL REGULATIONS AND NEW VEHICLE CONCEPTS. FACTORS AFFECTING DISC BRAKE DESIGN INCLUDE ENERGY DISSIPATION AND SUCH INSTALLATION TRENDS AS REDUCED OFFSET STEERING, DIVIDED CIRCUITS, AND DEVICES TO REDUCE VIBRATION, PAD RELEASE, AND BRAKE FLUID VAPORIZATION. CURRENT DESIGN CONFIGURATIONS OF BRAKE COMPONENTS ARE DESCRIBED, INCLUDING OPPOSED PISTON AND SLIDING CALIPERS, THE HYDRAULIC BODY, THE PAD ABUTMENT, SLIDE ARRANGEMENTS, AND THE CLAMP MEMBER. PIVOTING CALIPERS ARE DESCRIBED AND A SUMMARY PRESENTED OF SLIDING CALIPER TYPES. ALSO DESCRIBED ARE HANDBRAKES AND ADJUSTERS FOR DISC BRAKE SYSTEMS. DEVELOPMENT OF DRUM BRAKES IS REVIEWED AND THE BASIC CONFIGURATION EXPLAINED, INCLUDING RECENT ADVANCEMENTS IN ADJUSTER ARRANGEMENTS.

by W. R. NEWTON; A. C. W. WRIGHT  
GIRLING LTD., KINGS RD., TYSELEY, BIRMINGHAM,  
ENGLAND  
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### RECENT PROGRESS IN BRAKING TESTS BY USE OF A CAR DYNAMOMETER

A NEW DYNAMOMETER TEST BENCH IS DESCRIBED WHICH ALLOWS A MORE SCIENTIFIC APPROACH TO BRAKING TESTS THAN THAT OBTAINED BY ROAD TESTS, AT A LOWER COST AND WITH COMPLETE SAFETY, AS WELL AS REPRODUCIBILITY. AMONG

THE DATA PROCURABLE WITH THIS DEVICE ARE THOSE ON BRAKING RATIO, PIVOTING TORQUE, AND SWINGING OF A CAR DURING THE TRANSIENT PERIOD OF PITCH MOVEMENT. ACCURATE STUDIES MAY BE MADE OF BRAKING CORRECTING DEVICES, OF ROAD HOLDING CHARACTERISTICS DURING BRAKING, AND OF BEHAVIOR WHILE BRAKING ON A CURVE. VIBRATION AND WHEEL LOCK MAY ALSO BE MEASURED.

by J. A. ODIER; P. MOLINIER; J. THIRION DE BRIEL  
S.A.F. FERODO, PARIS, FRANCE  
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### DISC BRAKE SQUEAL

FOUR THEORIES ARE EXAMINED IN DETAIL WHICH HAVE BEEN PUT FORWARD SINCE 1960 TO EXPLAIN THE UNDERLYING MECHANISM OF DISC BRAKE SQUEAL. A CANTILEVER-DISC MODEL WAS USED FOR THE FIRST OF THESE THEORIES, WHICH IS EXPRESSED AS TWO-DEGREE-OF-FREEDOM WITH KINEMATIC RESTRAINT. THE SECOND THEORY, ON A PIN-DISC MODEL, IS EXPRESSED AS NONLINEAR SELF-EXCITED OSCILLATION, AND THE THIRD THEORY, BASED ON THE SAME MODEL, IS EXPRESSED AS THREE-DEGREE-OF-FREEDOM WITH KINEMATIC RESTRAINT. THE FOURTH THEORY, ON AN EIGHT-DEGREE-OF-FREEDOM MODEL, IS EXPRESSED AS BINARY FLUTTER OF TWO DISC MODES. THE SALIENT FEATURES OF THE MATHEMATICS INVOLVED ARE REPRODUCED AND THE THEORIES COMPARED TO BRING OUT THEIR ESSENTIAL FEATURES. A BRIEF EXAMINATION IS MADE TO DISCOVER HOW THE THEORIES EXPLAIN SUCH OBSERVED FACTS OF SQUEAL AS GENERATION OF HARMONICS, GENERATION OF SQUEAL OVER A LIMITED PRESSURE RANGE, GENERATION OF SIMULTANEOUS DISC MODES, AND GENERATION OF VIBRATIONS OVER A WIDE FREQUENCY RANGE. THE TWO MOST RECENTLY PURSUED THEORIES ARE THE THIRD AND FOURTH OF THOSE DESCRIBED ABOVE. THESE HAVE MATHEMATICAL SIMILARITIES BUT ARE PHYSICALLY QUITE DIFFERENT. TO RESOLVE THE DIFFERENCES BETWEEN THE TWO MODELS, IT WOULD APPEAR NECESSARY TO MEASURE THE AMPLITUDES AND PHASES OF THE FUNDAMENTAL DISC MODES DURING SQUEAL.

by M. R. NORTH  
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ENGLAND  
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### **A THEORY OF DRUM BRAKE SQUEAL**

A THEORETICAL ANALYSIS OF DRUM BRAKE SQUEAL HAS BEEN DEVELOPED IN WHICH ALLOWANCE IS MADE FOR THE VIBRATIONAL MODES AND THE CONTACT GEOMETRY OF THE SHOE AND DRUM. A CONSTANT COEFFICIENT OF FRICTION IS ASSUMED. THE THEORY WAS VERIFIED EXPERIMENTALLY USING A TWO LEADING-SHOE BRAKE. TRENDS IN EXPERIMENTAL RESULTS AND THEORETICAL PREDICTIONS WERE IN FAIRLY GOOD AGREEMENT. SOME PRACTICAL IMPLICATIONS OF THE THEORY FOR THE TYPE OF BRAKE CONSIDERED ARE THAT SQUEAL PROPENSITY IS REDUCED BY INCREASING THE MASS AND FLEXIBILITY OF THE SHOE, BY REDUCING THE DRUM MASS AND INCREASING THE DRUM STIFFNESS, AND BY REDUCING THE LINING MODULUS. INCREASING SHOE AND DRUM DAMPING SHOULD HAVE ONLY A SMALL EFFECT ON THE SQUEAL PROPENSITY OF THE MAIN MODE BUT IT SHOULD RESPECTIVELY INCREASE AND DECREASE THE PROPENSITY FOR THE HIGHER SQUEAL MODES.

by N. MILLNER

FERODO LTD., CHAPEL-EN-LE-FRITH, DERBY, ENGLAND

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### **IMPLICATIONS OF SOME CHARACTERISTICS OF DRIVERS FOR BRAKE SYSTEM PERFORMANCE**

STUDIES WERE REVIEWED OF THE MAXIMUM FOOT PEDAL FORCE OF DRIVERS, AND THE EFFECTS OF SOME BRAKE SYSTEM DESIGN VARIABLES ON DRIVER/VEHICLE BRAKING PERFORMANCE. AMONG THE VARIABLES EXAMINED WERE LEFT VERSUS RIGHT LEG STRENGTH; THE INFLUENCE OF SEX, BODY WEIGHT, AND AGE; ACTUATING LIMB ANGLES; SEAT CONFIGURATION; AND THE EFFECT OF EXPERIENCE AND MOTIVATION ON PERFORMANCE WITH A GIVEN BRAKE AND VEHICLE. A SURVEY WAS MADE OF KNOWLEDGE OF BRAKING CHARACTERISTICS OF VEHICLES AMONG DRIVERS AND AUTOMOBILE SERVICE PERSONNEL. IT WAS FOUND THAT DRIVERS TENDED TO UNDERESTIMATE REQUIRED STOPPING DISTANCE, ESPECIALLY ON WET PAVEMENT, AND THAT DRIVERS DID NOT UNDERSTAND, AS DID AUTOMOBILE SERVICE PERSONS, THE MECHANISM OF WHEEL LOCK IN SEVERE BRAKING SITUATIONS AND ITS EFFECTS UPON DIRECTIONAL CONTROL STABILITY. AMONG THE DYNAMIC BRAKING CONSIDERATIONS STUDIED WERE BRAKE MODULATION IN NORMAL AND MAXIMUM BRAKING. A VARIABLE RATIO MASTER CYLINDER WAS CITED AS A DEVICE FOR ENSURING GOOD BRAKE MODULATION FOR MOST BRAKE AP-

PLICATIONS AND ON LOW COEFFICIENT OF FRICTION SURFACES, ALTHOUGH NEITHER ITS PERFORMANCE NOR ITS ACCEPTANCE BY DRIVERS HAS BEEN EVALUATED. MAXIMUM BRAKE PEDAL FORCE SHOULD NOT BE MORE THAN 340 NEWTONS TO ACHIEVE 5.8 M/SEC/SEC AVERAGE DECELERATION FROM 97 KM/H; BRAKE SYSTEMS SHOULD OPERATE WITHIN AN ENVELOPE OF DEFINED DECELERATION AND PEDAL FORCE VALUES; ANTILOCKING SYSTEMS WOULD AID IN DIRECTIONAL CONTROL AND IN REDUCING DRIVER VARIABILITY IN BRAKING; AND TRAINING SHOULD EMPHASIZE BASIC KNOWLEDGE, AND TESTING ON HIGH COEFFICIENT SURFACES.

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### **ACCIDENTS INVOLVING LOSS OF CONTROL WHEN BRAKING - A STUDY OF THE ON-THE-SPOT SURVEY DATA**

A DETAILED STUDY OF ACCIDENTS WAS CARRIED OUT 'ON-THE-SPOT' TO ASSESS THE CONTRIBUTION OF ROAD, VEHICLE AND ROAD USER FACTORS TO ROAD ACCIDENTS. IN A PARTICULAR ANALYSIS OF 8% OF ACCIDENTS INVOLVING CARS IN WHICH CONTROL OF A CAR WAS LOST WHEN ITS DRIVER WAS BRAKING, SITES WERE DIVIDED ALMOST EQUALLY INTO FOUR CATEGORIES: LEFT BENDS, RIGHT BENDS, INTERSECTIONS, AND OTHER SITUATIONS. SLIPPERY SURFACES WERE NOT NECESSARILY PRESENT. DRIVERS HAD USUALLY DRIVEN TOO FAST EITHER FOR THE LAYOUT OR FOR UNEXPECTED TRAFFIC HAZARDS AND WERE MOST AT RISK WHEN DRIVING FOR SOCIAL REASONS. YOUNG DRIVERS WERE PARTICULARLY AT RISK ON DAMP OR WET ROADS OUTSIDE URBAN AREAS. BRAKING LOSS OF CONTROL ULTIMATELY RESULTED ALMOST EQUALLY IN SPINNING AND DRIFTING (I.E. SIDE SLIPPING). CAR BRAKING WAS GENERALLY WELL BALANCED ALTHOUGH LOAD AND DECELERATION SENSING MIGHT BE MORE USED TO INCREASE THE RANGE OF STABLE BRAKING. TIRE OR BRAKE DEFECTS CONTRIBUTED TO A SMALL MINORITY OF ACCIDENTS. THE USE OF FRONT AND REAR ANTILOCKING BRAKES MIGHT BE EXPECTED

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TO HALVE THE INCIDENCE OF BRAKING LOSS OF CONTROL.

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### **THE EFFECT OF SURGICAL OPERATION ON THE 'BRAKE-CLUTCH SIMULATOR'**

THE EFFECT OF LEFT AND RIGHT INGUINAL HERNIORRHAPHY ON THE ABILITY TO OPERATE AN AUTOMOBILE BRAKE AND CLUTCH WAS MEASURED ON A 'BRAKE-CLUTCH SIMULATOR.' THE CONSTRUCTION OF THE SIMULATOR IS DESCRIBED, AS ARE THE TEST PROCEDURES. ALL THE SUBJECTS WERE MEN HOLDING A CURRENT DRIVING LICENSE. THE EFFECT OF ANESTHETIC WAS MEASURED ON POSTOPERATIVE PATIENTS FROM OPERATIONS NOT INVOLVING THE TRUNK AND LEGS. THE EFFECT OF "LEARNING" WAS EXAMINED. PATIENTS WERE TESTED BEFORE OPERATION AND ON POSTOPERATIVE DAYS TWO, FOUR, AND SIX. TESTS WERE ALSO MADE ON DAY EIGHT FOR LEFT HERNIA PATIENTS AND ON DAY SEVEN FOR RIGHT HERNIA PATIENTS. IT WOULD APPEAR THAT NEITHER GENERAL ANESTHETIC NOR EXPERIENCE AND FATIGUE AFFECTS PERFORMANCE ON BRAKE AND CLUTCH SYSTEMS. THERE WAS CONSIDERABLE INDIVIDUAL VARIATION, SOME PATIENTS BEING APPARENTLY UNAFFECTED BY OPERATION. IT WAS CONCLUDED THAT CHANGES DUE TO INGUINAL HERNIA OPERATION ARE SMALL AND THAT RECOVERY TO PREOPERATIVE PERFORMANCE HAS OCCURRED BY THE SEVENTH POSTOPERATIVE DAY.

by C. WASTELL; I. WISE; J. F. COLIN  
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### **OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES**

THE HISTORY OF BRAKE DESIGN IS REVIEWED WITH EMPHASIS ON THE CONTINUITY OF DESIGN AND THE CHANGING ENVIRONMENT OF INCREASINGLY SEVERE CONDITIONS. VARIOUS BRAKE SYSTEMS

ARE DISCUSSED, ESPECIALLY THOSE FOR HEAVY VEHICLES, WITH REFERENCE TO THE FACTORS AFFECTING CHOICE OF BRAKES: DRIVER PREFERENCE, RELIABILITY, EASE OF MAINTENANCE, AND TOLERANCE IN MANUFACTURE. THERE IS A GROWING IMPORTANCE OF ACCURATE PERFORMANCE ANALYSIS AND MAINTENANCE COSTING. THESE METHODS SHOULD BE USED TO ADD A NEW DIMENSION TO DESIGN AND DEVELOPMENT TO ACHIEVE HIGHER LEVELS OF RELIABILITY. A MORE EFFECTIVE FORMULA MUST BE DEvised TO PROVIDE MANUFACTURERS WITH RAPID FEEDBACK FROM OPERATORS ON BRAKE PERFORMANCE.

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### **BRAKE DEFECTS IN CARS**

AS A FOLLOW-UP TO ON-THE-SPOT INVESTIGATIONS WHICH INDICATED THAT BRAKE DEFECTS WERE LARGELY RESPONSIBLE FOR ABOUT 3% OF ROAD ACCIDENTS, A THOROUGH EXAMINATION OF BRAKE DEFECTS IN TWO SAMPLES OF CARS WAS UNDERTAKEN. IN A TWO-YEAR SURVEY, 436 ACCIDENTS INVOLVED VEHICLES AND 341 VEHICLES BELONGING TO STAFF OF THE TRANSPORT AND ROAD RES. LAB. WERE EXAMINED, WHETHER OR NOT ANY DEFECT WAS SUSPECTED. THE CONDITION OF DISC/DRUMS, LININGS, HYDRAULIC CYLINDERS, ADJUSTERS, PIPES, HOSES, AND HANDBRAKE LINKAGES WERE INSPECTED. WHERE POSSIBLE SAMPLES OF BRAKE FLUID WERE TAKEN FROM THE MASTER CYLINDER AND A WHEEL CYLINDER FOR DETERMINATION OF WATER AND DIRT CONTENT. IN THE CASE OF ROADWORTHY VEHICLES, DECELEROMETER READINGS WERE RECORDED FOR FOOTBRAKE AND HANDBRAKE. THE PROPORTIONS OF VEHICLES WITH DEFECTS WERE VERY SIMILAR FOR THE TWO SAMPLES: 83% OF THE ACCIDENT INVOLVED VEHICLES AND 85% OF THE COMPARATIVE SAMPLE VEHICLES HAD AT LEAST ONE DEFECT. THE NUMBER OF DEFECTS PER VEHICLE AVERAGED 4.5 IN BOTH SAMPLES AND THERE WERE NO SIGNIFICANT DIFFERENCES IN THE NUMBER OR TYPES OF DEFECTS FOUND. FAULTY ADJUSTMENT WAS THE MOST COMMON DEFECT FOUND; MORE SERIOUS BUT LESS FREQUENT DEFECTS WERE FAULTY OR WORN LININGS AND FAULTY DISCS OR DRUMS (BOTH OFTEN DUE TO BRAKE FLUID OR OIL CONTAMINATION), AND LEAKING OR SEIZED WHEEL CYLINDERS. INSUFFICIENT FLUID WAS THE MOST COMMON DEFECT IN THE BRAKE MASTER CYLINDER. IT IS RECOMMENDED THAT MORE REGULAR CHECKING BE CARRIED OUT AS PART OF NORMAL SERVICING. THIS WOULD LEAD TO IMPROVEMENTS

IN BRAKE MAINTENANCE AND A REDUCTION IN THE NUMBER OF DEFECTS.

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#### **DEFECTS IN ROAD VEHICLE BRAKING SYSTEMS-- EXPERIENCE FROM STATUTORY INSPECTIONS**

DEFECTS FOUND IN MOTOR VEHICLE BRAKING SYSTEMS DURING STATUTORY EXAMINATIONS OF VEHICLES IN THREE CATEGORIES (HEAVY GOODS VEHICLES, LIGHT GOODS VEHICLES AND PASSENGER CARS, AND PUBLIC SERVICE VEHICLES (BUSES)) ARE DISCUSSED. THE METHODS OF INSPECTION AND THE EQUIPMENT USED ARE DESCRIBED. BRAKE DEFECTS CONSTITUTE A LARGE PROPORTION OF TOTAL MECHANICAL DEFECTS IN ALL CLASSES OF VEHICLES. LOW BRAKING EFFICIENCY IS A PRIME REASON FOR REJECTION OF HEAVY GOODS VEHICLES, POSSIBLY DUE TO POOR PREPARATION FOR THE TEST, ALTHOUGH PUBLIC SERVICE VEHICLES ARE FREQUENTLY REJECTED FOR THE SAME DEFECT. DEFECTS OF MECHANICAL BRAKING COMPONENTS AND OF BRAKE PIPES AND RESERVOIRS CONSTITUTE A LARGE PROPORTION OF DEFECTS IN ALL VEHICLE CLASSES. SOME OF THESE DEFECTS ARE ATTRIBUTABLE TO FAULTY DESIGN AND CONSTRUCTION OF SUCH COMPONENTS AS MECHANICAL BRAKE CONNECTIONS, JOINTS IN PNEUMATIC SYSTEMS, AND BRAKE PIPE SUPPORTS. MANUFACTURERS COULD ALSO PROVIDE BETTER PROVISION FOR CHECKING THE INTEGRITY OF DIVIDED BRAKE SYSTEMS AND IMPROVEMENTS IN THE DESIGN OF LOAD SENSING VALVES. IT IS RECOMMENDED THAT STATUTORY EXAMINATION OF ALL VEHICLES BE ALIGNED MORE CLOSELY WITH THE STANDARDS AND PROCEDURES OF HEAVY GOODS TESTING STATIONS.

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#### **THEORY OF RELIABILITY AND ITS APPLICATION TO VEHICLE BRAKES AND BRAKING SYSTEMS**

THE APPLICATION OF RELIABILITY THEORY IN THE FIELD OF VEHICLE BRAKING SYSTEMS REQUIRES INTRODUCTION OF CERTAIN SUPPLEMENTS IN THE BASIC THEORY IN ORDER TO INCLUDE SUCH SPECIFIC FEATURES AS BRAKING SYSTEM FAILURE (ELEMENT RELIABILITY), SYSTEM ELEMENT CONNECTIONS (SYSTEM RELIABILITY), AND THE CRITICALITY OF ELEMENTS (SIMPLIFIED RELIABILITY FUNCTION). THE MAIN PROBLEM IS THE DERIVATION OF ADEQUATE RELIABILITY FUNCTION MODELS WHICH SHOULD BE BASED ON ANALYSES OF SYSTEM CONSTRUCTION AND TYPES OF FAILURES. BESIDES, OWING TO THE SYSTEM'S COMPLEXITY, IT IS HIGHLY ADVISABLE TO ANALYZE ONLY THOSE ELEMENTS WHOSE CRITICALITY IS THE GREATEST. ONCE THE ADEQUATELY FORMULATED RELIABILITY FUNCTIONS ARE ON HAND, RELIABILITY INVESTIGATIONS OF BRAKING SYSTEM ELEMENTS SHOULD BE TURNED IN THREE BASIC DIRECTIONS: BEHAVIOR OF THE SYSTEM IN OPERATION, ACTUAL WORKING LOADS UNDER USAGE CONDITIONS, AND LABORATORY TESTS SIMULATING THE ACTUAL OPERATING CONDITIONS.

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#### **RELIABILITY AND MAINTAINABILITY OF BRAKING SYSTEMS--MILITARY APPLICATIONS**

THE MAINTENANCE LOAD IMPOSED BY VEHICLE BRAKING SYSTEMS IS EXPLAINED IN RELATION TO THE TOTAL MAINTENANCE LOAD FOR A NUMBER OF CARGO VEHICLES IN MILITARY USE. THE DIFFERING CONDITIONS OF MILITARY USAGE, SUCH AS CROSS COUNTRY DRIVING, LOADING PARAMETERS, AND STORAGE TIME, ARE EXPLAINED AND THE CONSEQUENT EFFECTS ON BRAKING PERFORMANCE ASSESSED. THE CHARACTERISTICS OF THE DIFFERENT BRAKING SYSTEMS IN USE HAVE DIFFERENT EFFECTS ON THE RELIABILITY OF THE SYSTEM, PARTICULARLY IN REGARD TO MUD AND DUST CONTAMINATION. THE DESIGN REQUIREMENTS OF MILITARY VEHICLES CAN SOMETIMES RESULT IN BRAKE COMPONENT LOCATIONS WHICH ARE FAR FROM IDEAL, WITH DETRIMENTAL RESULTS ON RELIABILITY AND MAINTAINABILITY. POSSIBLE WAYS OF MINIMIZING THESE PROBLEMS ARE SUGGESTED, SUCH AS THE USE OF RETARDERS, AUTO-ADJUSTORS, AND "ROLLING ROAD" TESTING METHODS. IMPROVED BRAKE FLUIDS SUCH AS SILICONE BRAKE FLUID, PACKAGED IN SMALLER CON-



TAINERS, ARE ALSO RECOMMENDED, AS ARE AIR DRYERS FOR AIR BRAKE SYSTEMS. MILITARY APPLICATION OF CARBON BRAKES MAY BE WORTH CONSIDERING IN THE FUTURE ON SOME VEHICLES.

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### LEGISLATIVE CONTROL OF ARTICULATED VEHICLE BRAKING [EUROPE]

MATCHING THE BRAKING FORCES ON THE TRACTOR AND SEMITRAILER OF AN ARTICULATED VEHICLE TO MINIMIZE SITUATIONS LEADING TO COMBINATION INSTABILITY HAS BEEN RECOGNIZED AND LEGISLATIVE CONTROL DISCUSSED FOR SOME TIME. OUTLINED ARE LEGISLATION DEVELOPMENTS FROM THE EARLY 1960'S TO THE MID 1970'S ON ARTICULATED VEHICLE BRAKING CULMINATING IN THE EUROPEAN ECONOMIC COMMUNITY DIRECTIVE 75/524/EEC. INSIGHT IS GIVEN INTO THE WAY A TECHNICAL REGULATION IS DEVELOPED BY EUROPEAN AUTHORITIES. AMONG THE PARAMETERS INVOLVED IN ARTICULATED VEHICLE BRAKING ARE PREVENTION OF PREMATURE FRONT AXLE LOCKING ON POOR ADHESION SURFACES, CONSISTENT BRAKING PERFORMANCE, ADEQUATE MATCHING OF PRE AND POST EEC/ECE (ECONOMIC COMMISSION FOR EUROPE/EUROPEAN ECONOMIC COMMUNITY) LEVEL TRACTORS AND SEMITRAILERS, AND AVOIDANCE OF RESTRICTING THE OPERATION OF DIFFERENT VEHICLE TYPES.

by P. D. LIVINGSTONE

FORD MOTOR CO., LAINDON, ESSEX, ENGLAND

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### BRAKING REGULATIONS IN EUROPE

IMPORTANT NEW BRAKING REGULATIONS FOR MOTOR VEHICLES AND TRAILERS HAVE RECENTLY BEEN INTRODUCED BY SWEDEN, THE ECONOMIC COMMISSION FOR EUROPE (ECE), AND THE EUROPEAN ECONOMIC COMMUNITY (EEC). THE RELEVANT RULEMAKING PROCEDURES ARE DESCRIBED, AS ARE THE INTERNATIONAL ORGANIZATIONS WHICH PROVIDE FOR INDUSTRY PARTICIPATION. THE TECHNICAL CONTENT OF THESE REGULATIONS IS SUMMARIZED AND SPECIFIC EXAMPLES OF DIFFICULT, INTERESTING, OR UNUSUAL DEMANDS ARE HIGHLIGHTED. SOME COMPARISONS WITH THE APPROPRIATE U.S. FEDERAL STANDARDS HAVE BEEN INCLUDED AND THE EUROPEAN METHOD OF TYPE APPROVAL IS EXPLAINED AGAINST THE BACKGROUND OF SELF-CERTIFICATION IN THE U.S. SEVERAL NEW EUROPEAN PROPOSALS FOR TRACTOR/TRAILER COMPATIBILITY, BRAKE APPORTIONING, AND ANTISKID SYSTEMS ARE REVIEWED TO ILLUSTRATE THE CURRENT STATUS OF LEGISLATIVE PROGRESS IN EUROPE. THREE ESPECIALLY IMPORTANT EUROPEAN BRAKING REGULATIONS SUMMARIZED ARE ECE REGULATION 13, EEC DIRECTIVE 71/320, AND SWEDISH REGULATION F.18. IN SPITE OF SIGNIFICANT DIFFERENCES IN SYSTEM REQUIREMENTS, TEST PROCEDURES, AND ACCEPTANCE LEVELS, THERE ARE NO FUNDAMENTAL REASONS WHY THE TECHNICAL REQUIREMENTS IN EUROPE AND THE U.S. CANNOT BE RECONCILED, LEADING TO THE EVENTUAL ADOPTION OF UNIFORM WORLD-WIDE BRAKING REGULATIONS.

by PAUL OPPENHEIMER  
GIRLING LTD., BIRMINGHAM, ENGLAND  
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### REVIEW OF BRAKING LEGISLATION IN BRITAIN DURING THE PAST DECADE

THE MAIN CHANGES IN BRAKING LEGISLATION IN BRITAIN ARE REVIEWED AND INDICATIONS OF POSSIBLE FUTURE CHANGES ARE GIVEN. DURING THE PAST TEN YEARS, CHANGES IN DESIGN AND CONSTRUCTION OF COMMERCIAL BRAKING SYSTEMS HAVE PRIMARILY INVOLVED ARTICULATED VEHICLES, ALTHOUGH OTHER VEHICLE CLASSES HAVE BEEN AFFECTED. APPLICATION OF SECONDARY AND PARKING BRAKES HAS BEEN IMPROVED IN PERFORMANCE AND STABILITY. SERVICE BRAKING SYSTEMS HAVE BEEN IMPROVED THROUGH BETTER BRAKING DISTRIBUTION AND LOAD APPORTIONING DEVICES. ANTILOCKING BRAKES HAVE BEEN ENCOURAGED AND ARE FITTED TO A SIGNIFICANT NUMBER OF GOODS VEHICLES. SPRING BRAKES AND LOCK ACTUATORS HAVE BEEN INTRODUCED, AS HAVE DOUBLE AND TRIPLE DIAPHRAGM ACTUATORS. BRAKE MAINTENANCE HAS BEEN IMPROVED DUE TO MANDATORY ANNUAL INSPECTION AT GOVERNMENT TESTING STATIONS, INTRODUCED IN 1968. VEHICLE OVERLOADING AND BRAKE OVERHEATING PROBLEMS HAVE BEEN MINIMIZED BY 'PLATING' INTRODUCED IN 1966 AND 1968, AND HAVE BEEN FURTHER MINIMIZED BY INCREASED ENFORCEMENT OF WEIGHT LIMITATIONS BY OFFICERS AT THE ROADSIDE. VEHICLE ACCIDENT RATES HAVE BEEN REDUCED, AP-



DEPARTMENT OF THE ENVIRONMENT, SOUTHWARK ST., LONDON SE1, ENGLAND  
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### **AIR BRAKING SYSTEMS WITH INCREASED PRESSURE**

DIFFERENT METHODS ARE DESCRIBED OF APPLYING INCREASED PRESSURE LEVELS TO AIR BRAKE SYSTEMS IN ORDER TO REDUCE RESERVOIR CAPACITY AND SPACE REQUIREMENTS FOR EQUIPMENT. THE HIGHEST PRESSURE LEVEL TECHNICALLY POSSIBLE IS DETERMINED BY THE PROPERTIES OF BRAKE COMPONENTS: COMPRESSOR, RESERVOIRS, PIPES AND SCREW COUPLINGS, AND SEALING ELEMENTS. THE MAIN CHARACTERISTICS OF THESE COMPONENTS IN DIFFERENT AIR BRAKING SYSTEMS ARE EXPLAINED AND COMPARED. FOR COMMERCIAL VEHICLES, HIGH PRESSURE CAN BE APPLIED IN FULL HIGH PRESSURE OR IN MIXED INSTALLATIONS, THE LIMIT OF PRESSURE BEING SET BY THE COMPRESSOR'S COOLING CAPACITY, AND DRIVE PROBLEMS RESULTING FROM HIGH DRIVE TORQUES AND TORQUE OSCILLATIONS.

by OTTO EHRICKE  
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### **A REVIEW OF COMMERCIAL VEHICLE BRAKES**

IMPROVEMENTS IN VEHICLE BRAKE TEMPERATURE CAN BE ACHIEVED BY FORCED CONVECTION AND BY IMPROVED DRUM DESIGN TO INCREASE DISSIPATION. HOWEVER, THE RATE OF INPUT OF POWER CAN ALSO CREATE PROBLEMS AND DRUM BRAKES SHOULD BE CONSIDERED VERY CAREFULLY FOR HIGH ENERGY APPLICATIONS. DISC BRAKES DO NOT OFFER ADVANTAGES IN THE SAME PROPORTIONS AS WHEN FITTED TO MOTOR CARS. FOR A GIVEN ENERGY RATING, RELATIVE TO A DRUM BRAKE, THE SPACE REQUIRED BY A DISC BRAKE IS NOT MUCH DIFFERENT. WORKING TEMPERATURES ARE GENERALLY HIGHER WITH CONSEQUENT EFFECTS ON PAD LIFE AND IMMEDIATE ENVIRONMENT. MULTI-PLATE DISC STACKS ARE NOW A FEASIBLE

TURE MAY BE A LIQUID COOLED MULTI-PLATE STACK. THIS IS ACTUALLY BEING TRIED AND PRESENT BY AN AMERICAN MANUFACTURER, IN A PUBLIC SERVICE VEHICLE (BUS) APPLICATION. SUCH A BRAKE CAN SUBSTANTIALLY INCREASE BOTH TORQUE AND ENERGY RATINGS BUT PIPING AND HEAT EXCHANGERS COMPLICATE THE VEHICLE. AUXILIARY BRAKES AND RETARDERS CAN ACCEPT A CONSIDERABLE PART OF THE TOTAL BRAKING ENERGY, BUT SUCH DEVICES ARE NOT WITHOUT THEIR PROBLEMS. NOT LEAST OF THESE IS THE VEHICLE STABILITY PROBLEM RESULTING FROM THE APPLICATION OF UP TO 10% OF THE VEHICLE'S PLATED GROSS WEIGHT, AS BRAKING FORCE, AT ONE AXLE. IN THE CASE OF ARTICULATED VEHICLES ON LOW MU SURFACES, THIS CAUSE SERIOUS ADHESION LOSS AND SUITABLE LOAD OR RETARDATION SENSITIVE MODULATION IS REQUIRED. CURRENT BRAKE TECHNOLOGY CAN STILL COPE WITH CURRENT AXLE LOADS AND PERFORMANCE. HOWEVER, UNLESS BRAKES ARE DEVELOPED WHICH CAN ALLOW GREATER CAPACITY IN THE AVAILABLE SPACE, SERIOUS CONSIDERATION SHOULD BE GIVEN TO INCREASING THE NUMBER OF AXLES ON A VEHICLE IF ITS PERFORMANCE IS TO INCREASE STILL FURTHER.

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HS-022 600

### **DISC BRAKES FOR COMMERCIAL VEHICLES**

DISC BRAKES FOR COMMERCIAL VEHICLES IMPROVE TRAFFIC SAFETY BY PROVIDING MORE STABLE BRAKING BEHAVIOR, IMPROVED THERMAL CHARACTERISTICS, AND AVAILABILITY OF DUAL CIRCUITRY. ANOTHER ADVANTAGE OF DISC BRAKES IS REDUCED MAINTENANCE COSTS FOR PAD REPLACEMENT AND VEHICLE DOWN TIME. COMPARISON OF CHARACTERISTIC VALUES AND SENSITIVITIES OF VARIOUS DRUM BRAKES PRESENTLY USED IN COMMERCIAL VEHICLES WITH THOSE OF THE DISC BRAKE SHOWS THAT DISC BRAKES ARE SAFER. THE THERMAL BEHAVIOR OF DRUM AND DISC BRAKES CAN BE DEFINED BY A PERFORMANCE RATING BASED ON THE PERMISSIBLE THERMAL LOAD WHICH CAN BE ABSORBED BY A BRAKE WITHIN A SPECIFIC TIME. THAT LOAD IS DEPENDENT ON THE FRICTION PADS USED AND ON THE COUNTERMATERIAL. THE BEST BRAKE DISC MATERIALS ARE THOSE WHICH HAVE THE HIGHEST PERMISSIBLE TENSIONS POSSIBLE AND THE LOWEST EXPANSION AND ELASTICITY MODULUS

VEHICLES IS REVIEWED. THE FLOATING FIST-TYPE CALIPER CONCEPT IS THE OPTIMAL SOLUTION OF ALL PROBLEMS ARISING IN CONNECTION WITH A DISC BRAKE DESIGN FOR HEAVY VEHICLES.

by HERBERT SCHMIDT  
ALFRED TEVES, G.M.B.H., FRANKFURT/MAIN, WEST GERMANY  
Publ: HS-022 566 (I-MECH-E-CONFERENCE-PUBLICATIONS-1976-5), "BRAKING OF ROAD VEHICLES," LONDON, 1977 P311-20  
Rept. No. C71/76; 1977; 5REFS  
PRESENTED AT INSTITUTION OF MECHANICAL ENGINEERS CONFERENCE, LOUGHBOROUGH, LEICS., 23-25 MAR 1976.  
Availability: IN HS-022 566

HS-022 601

### **BRAKE PERFORMANCE AND COSTS-- COMMERCIAL VEHICLES**

CURRENT TYPICAL COMMERCIAL VEHICLE FLEET BRAKING PERFORMANCE AND COSTS ARE REVIEWED. THE 1968 ROAD TRAFFIC ACT BROUGHT ABOUT A SIGNIFICANT IMPROVEMENT IN THIS PERFORMANCE THROUGH ANNUAL BRAKE ROLLER TESTING, AND ACCIDENTS DUE TO BRAKE FAILURES HAVE BECOME A RARITY. MOTOR MANUFACTURERS NEED TO REASSESS THE RECOMMENDED BRAKE COMPONENT REPLACEMENT INTERVALS. THE INTRODUCTION OF A COMPACT MULTI DISC BRAKE OFFERS MANY ADVANTAGES, ALTHOUGH AUTOMATIC BRAKE ADJUSTERS WOULD ELIMINATE FRICTIONAL LOSSES AND ALLIED FUEL COSTS. REGULAR INSPECTION AND SYSTEMATIC PREVENTIVE MAINTENANCE CAN CONTRIBUTE TO ACHIEVING THE STATUTORY BRAKING STANDARDS FOR BRITISH COMMERCIAL VEHICLES. VEHICLES OPERATING IN HIGH DENSITY AREAS HAVE BRAKE MAINTENANCE COSTS EQUAL TO HIGH MILEAGE "TRUNKER" VEHICLES. OIL SEAL FAILURES ARE RESPONSIBLE FOR INCREASING BRAKE MAINTENANCE COSTS. FORTY PERCENT OF BRAKE DEFECTS WERE FOUND TO BE MINOR AIR JOINT LEAKS, INDICATING A NEED FOR IMPROVED MANUFACTURING TOLERANCES. BRAKE REPAIRS COMPRISE FROM 10% TO 20% OF ALL REPAIR ORDERS AND 6%-12% OF OVERALL MAINTENANCE COSTS. THERE IS A REQUIREMENT FOR REDUCING AIR BRAKE NOISE LEVELS AND BRAKE DRUM SQUEAL. SYSTEMATICALLY CHECKED AND ADJUSTED LOAD SENSING VALVES WILL ELIMINATE BRAKE-INDUCED JACKKNIFING, BUT BETTER DESIGN OF BRAKE EQUIPMENT IS URGENTLY NEEDED.

by ROGER DENNISS  
BASS PRODUCTION LTD., BURTON-ON-TRENT, ENGLAND  
Publ: HS-022 566 (I-MECH-E-CONFERENCE-PUBLICATIONS-1976-5), "BRAKING OF ROAD VEHICLES," LONDON, 1977 P321-4  
Rept. No. C78/76; 1977  
PRESENTED AT INSTITUTION OF MECHANICAL ENGINEERS CONFERENCE, LOUGHBOROUGH, LEICS., 23-25 MAR 1976.  
Availability: IN HS-022 566

### **VEHICLES IN COMPLIANCE WITH THE EEC- DIRECTIVE 71/320 BRAKING**

A UNIVERSAL METHOD IS DESCRIBED FOR DEFINING THE BRAKING FORCE CONTROL REQUIREMENTS AND THE LAYOUT OF REGULATORS FOR MOTOR VEHICLES, INCLUDING SOME SEMI-TRAILER TRACTORS AND TRAILERS, TO MEET THE NEW REQUIREMENTS OF THE EUROPEAN ECONOMIC COMMUNITY (EEC) LEGISLATION FOR BRAKING FORCE DISTRIBUTION, BRAKE ADHESION, AND COMPATIBILITY. THE APPLICATION OF THIS METHOD IS DEMONSTRATED ON A SAMPLE VEHICLE, RESULTING IN THE CONCLUSION THAT NO HIGHER GOVERNOR RATIOS THAN 4:1 ARE NECESSARY, NOR ARE CONTROLS ON OTHER THAN REAR AXLES. FUNCTIONS AND CHARACTERISTICS ARE DESCRIBED OF EQUIPMENT WHICH HAS RESULTED FROM THE EEC REQUIREMENTS, SUCH AS THE QUADRUPLE PROTECTION VALVE, THE TWO-CIRCUIT TRAILER CONTROL VALVE, AND THE PARKING BRAKE VALVE WITH CHECK POSITION.

by OTTO EHRICKE  
WABCO WESTINGHOUSE G.M.B.H., HANNOVER, GERMANY  
Publ: HS-022 566 (I-MECH-E-CONFERENCE-PUBLICATIONS-1976-5), "BRAKING OF ROAD VEHICLES," LONDON, 1977 P325-37  
Rept. No. C72/76; 1977  
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Availability: IN HS-022 566

HS-022 603

### **THE TARGET CAR PROGRAM FOR 1977**

THE TARGET CAR PROG. OF THE AUTOMOTIVE ENGINEERING DEPT. OF THE AUTOMOBILE CLUB OF SOUTHERN CALIFORNIA IS DESCRIBED, AND THE RANKING OF 24 CURRENT MODEL YEAR CARS (1977) AGAINST A "TARGET" AUTOMOBILE ACCORDING TO KEY CHARACTERISTICS IS PRESENTED. THE INTENT OF THE TARGET CAR PROG. IS TO DEFINE AN OPTIMUM DESIGN AUTOMOBILE WHICH WILL BEST MEET A BROAD MIDDLE SEGMENT OF THE TRANSPORTATION NEEDS OF THE MOTORING PUBLIC. THE DESIGN SHOULD BALANCE AND OPTIMIZE CHARACTERISTICS SERVING ENVIRONMENTAL, SAFETY, AND CONSERVATION GOALS, AS WELL AS OTHER ESSENTIAL CHARACTERISTICS SUCH AS TRANSPORTATION CAPABILITY, COMFORT, AND GOOD PERFORMANCE. THE PROGRAM IS NOT, NOR WAS IT EVER INTENDED TO BE, AN ALL-ENCOMPASSING CONSUMER GUIDE TO NEW CAR PURCHASING. THERE ARE A NUMBER OF FACTORS, E.G. PRICE, STYLE, REPAIRABILITY, AND DURABILITY, WHICH WOULD HAVE TO BE CONSIDERED IN A BUYER'S GUIDE. TARGET CAR RESULTS MAY PROVE TO BE USEFUL TO THE CONSUMER, BUT THE PROGRAM IS DIRECTED AT THE MANUFACTURER AS A MEANS BY WHICH A REASONABLE CONSTRUCTIVE TARGET TO AIM AT IS PROVIDED. THE FOLLOWING 11 KEY

CHARACTERISTICS HAVE BEEN SELECTED FOR EVALUATING AUTOMOBILES AGAINST THE THEORETICAL OPTIMUM VEHICLE: FUEL ECONOMY, LARGE INTERIOR SIZE, PASSING/ACCELERATION ABILITY, LOW INTERIOR NOISE, SMALL EXTERIOR SIZE, CRASHWORTHINESS, LUGGAGE/PARCEL CAPACITY, HANDLING, RIDE QUALITY, EASE OF ENTRY AND EXIT, AND MANEUVERABILITY. RATINGS ARE TABULATED FOR 24 CURRENT MODELS WHICH WERE SUBJECTIVELY AND OBJECTIVELY TESTED; THE METHODOLOGY FOR EVALUATING THE VEHICLE CHARACTERISTICS IS APPENDED. IN 1975 AND 1976 CARS MANUFACTURED ABROAD DOMINATED THE UPPER ECHELONS OF THE TARGET CAR RATINGS. IN 1977 MORE CARS FROM U.S. MANUFACTURERS HAVE MOVED CLOSER TO THE STANDARD CONSIDERED "IDEAL" FOR TODAY'S TYPICAL MOTORING NEEDS AND CIRCUMSTANCES.

by JOHN W. MCDONALD; LOUIS J. BINTZ; MAURY KRAMER  
AUTOMOBILE CLUB OF SOUTHERN CALIFORNIA,  
ENGINEERING AND TECHNICAL SERVICE DIV.  
Rept. No. SAE-780130; 1978; 16P  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
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## **EFFICIENT VEHICLE PACKAGING WITH FRONT-WHEEL DRIVE**

TO ACHIEVE IMPROVED PACKAGING EFFICIENCY AND FLEXIBLE ARRANGEMENTS OF AVAILABLE SPACE OF ITS AUTOMOBILES, RENAULT HAS UTILIZED FRONT-WHEEL DRIVE IN A NEW SERIES OF PASSENGER CARS. THE DEVELOPMENT OF FOUR OF THESE VEHICLES (R-5, R-14, R-20/30, AND A FUTURE RENAULT VEHICLE) IS OUTLINED, AND BOTH SIMILAR AND UNIQUE SOLUTIONS ADOPTED TO ACHIEVE ENGINEERING AND MARKETING OBJECTIVES ARE ILLUSTRATED. IN RESPONSE TO THE EUROPEAN PUBLIC'S DESIRE DURING THE 1960'S TO HAVE AUTOMOBILES PROVIDE MORE OBJECTIVE NEEDS OF ECONOMY AND UTILITY WHILE STILL OFFERING PERSONAL SAFETY AND COMFORT, RENAULT CHOSE TO DESIGN THE REAR PORTIONS OF ITS VEHICLES TO BE FREE OF MECHANICAL COMPONENTS AND TO INCORPORATE A REAR HATCH DOOR AS WELL AS FOLDABLE, DISPLACEABLE, AND REMOVABLE REAR SEATS IN ORDER TO PROVIDE VARIOUS ARRANGEMENTS OF THE AVAILABLE SPACE. THESE MAJOR PACKAGING DECISIONS RESULTED IN THE USE OF FRONT-WHEEL DRIVE DESIGN ON ALL HIGH VOLUME RENAULT VEHICLES. HOWEVER, ON A GLOBAL SCALE, IT SEEMS THAT A CONSIDERABLE NUMBER OF CONSUMERS REMAIN ATTACHED TO THE AUTOMOBILE OF TRADITIONAL FORM AND PROPORTIONS, I.E. A SEDAN-TYPE VEHICLE WITH A CLEARLY DISTINCT LUGGAGE COMPARTMENT. FOR THIS REASON, RENAULT DECIDED NOT TO NEGLECT THIS SEGMENT OF THE CAR-BUYING MARKET AND DOES OFFER MODELS WHICH RETAIN THE VISUAL APPEAL OF THE TRADITIONAL SEDAN OR NOTCH BACK

THEME WHILE INCORPORATING THE ESSENTIAL ADVANTAGES OF IMPROVED COMFORT AND SAFE HANDLING ASSOCIATED WITH FRONT-WHEEL DRIVE DESIGN, AS WELL AS LONG TRAVEL SUSPENSIONS AND VERY CAREFULLY CONCEIVED SEATS. TO SATISFY THE REQUIREMENTS OF THE CUSTOMER WHO PREFERS A VERY FUNCTIONAL AND NON-TRADITIONAL VEHICLE PACKAGE, RENAULT OFFERS A SERIES OF VEHICLES CLASSIFIED AS A "TWO BOX" MODEL (R-5, R-14, R-20/30). FOR CONSUMERS WHO PREFER A MORE CLASSICAL TYPE OF VEHICLE WITH A DISTINGUISHABLE LUGGAGE COMPARTMENT AND A CONVENTIONAL STATION WAGON DERIVATIVE, RENAULT OFFERS A "THREE BOX" MODEL (FUTURE RENAULT VEHICLE).

by PETER PHILLIPS; ANDRE DANIEL; ROGER REBIFFE  
RENAULT TECHNICAL CENTER, BELLEVILLE, MICH.;  
RENAULT, FRANCE  
Rept. No. SAE-780131; 1978; 15P  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 605

## **AN OVERALL DESIGN APPROACH TO IMPROVING PASSENGER CAR FUEL ECONOMY**

THE APPROACH USED IN THE DESIGN OF GENERAL MOTORS' NEW 1978 INTERMEDIATES AS AN EXAMPLE OF HOW IMPROVED FUEL EFFICIENCY CAN BE ACHIEVED IS PRESENTED. GOVERNMENT REGULATIONS, MARKETING PRESSURES, AND DESIGN FACTORS, ALL OF WHICH CAN AFFECT FUEL ECONOMY, ARE OUTLINED. A DESCRIPTION IS GIVEN OF THE PROCESSES BY WHICH VEHICLE ENVIRONMENTAL PROTECTION AGENCY (EPA) FLEET FUEL ECONOMY AND INERTIA WEIGHT CLASS GOALS WERE ESTABLISHED. IMPROVEMENTS IN FUEL CONSUMPTION WERE ACHIEVED BY THE FOLLOWING THREE MEANS WHICH ARE DISCUSSED IN DETAIL: WEIGHT REDUCTION, POWERTRAIN COMPONENT OPTIMIZATION, AND REDUCED ROAD LOAD HORSEPOWER. WEIGHT WAS REDUCED BY APPLICATION OF VEHICLE REPACKAGING AND EXTERIOR SIZE REDUCTION, MATERIAL SUBSTITUTIONS, AND IMPROVED COMPONENT AND SYSTEM DESIGN EFFICIENCIES WHICH RESULTED IN AN AVERAGE (SALES WEIGHTED) REDUCTION OF 630 LBS., OR AT LEAST ONE INERTIA WEIGHT CLASS COMPARED TO 1977 MODELS. POWERTRAINS WERE OPTIMIZED BY A THOROUGH ANALYSIS OF SIZING THE ENGINE AND ALL OTHER DRIVETRAIN COMPONENTS TO THE VEHICLE. AS A RESULT, FIVE NEW ENGINE DESIGNS EVOLVED, PRIMARILY IN SMALLER DISPLACEMENTS. ENGINE-RELATED ACCESSORIES SUCH AS AIR CONDITIONING WERE ALSO IMPROVED FOR INCREASED EFFICIENCY. ROAD LOAD HORSEPOWER REQUIREMENTS WERE MINIMIZED THROUGH CAREFUL ATTENTION TO AERODYNAMIC DRAG EFFECTS AS WELL AS ROLLING RESISTANCE REDUCTIONS IN DRIVETRAIN COMPONENTS, PRIMARILY TIRES. THE COMBINED EFFECT OF ALL THESE IMPROVEMENTS WAS AN INCREASE OF 2.6 MPG (EPA COMPOSITE SCHEDULE) OR 15% OVER COMPARABLE 1977 MODELS. CONSERVATIVE ESTIMATES PLACE THIS

FLEET FUEL SAVINGS AT 245 MILLION GALLONS FOR THE 1978 MODEL YEAR. ALSO DISCUSSED ARE THE PRINCIPAL ENGINEERING TECHNIQUES UTILIZED IN THE PROGRAM, WITH PARTICULAR EMPHASIS ON NEW METHODS AND ANALYSIS TOOLS EMPLOYED. THIS DISCUSSION INCLUDES THE FOLLOWING PROCEDURES: WEIGHT COMPOUNDING TECHNIQUE, FINITE-ELEMENT ANALYSES, 3/8-SCALE PLASTIC STRUCTURAL MODELS, VEHICLE "ON-BOARD" STRUCTURAL INSTRUMENTATION, ENGINE SIZE OPTIMIZATION ANALYSIS, POWERTRAIN PERFORMANCE AND ECONOMY SIMULATIONS, WIND TUNNEL TESTING, ENERGY BALANCE CONSIDERATIONS, CUSTOMER CLINICS, AND MISCELLANEOUS TRADITIONAL DESIGN TECHNIQUES.

by EDWARD K. HANSON  
GENERAL MOTORS CORP., BUICK MOTOR DIV.  
Rept. No. SAE-780132; 1978; 24P 7REFS  
TECHNICAL PAPER SERIES. PRESENTED AT CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
Availability: SAE

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### A SCALE MODEL SIMULATION OF VEHICLE MOTIONS

TWO SCALE MODEL CARS (ONE-SEVENTH SIZE OF 1400-2000 CC CLASS AUTOMOBILES) WERE DEVELOPED AND APPLIED IN SIMULATING GENERAL VEHICLE MOTIONS, WITH EMPHASIS PLACED ON VEHICLE OVERTURN DUE TO DRASTIC STEERING. THE TWO MODELS HAVE SUSPENSIONS, PNEUMATIC TIRES, SHOCK ABSORBERS, AND STEER MECHANISM. THESE MODELS HAVE NO ENGINE OR DRIVETRAIN BECAUSE THE TESTS ARE PERFORMED FOR COASTING CONDITIONS, AND THE MODELS ARE SHOT BY CATAPULT.

by SHIGEMI YOSHIDA  
MECHANICAL ENGINEERING LAB. [JAPAN]  
Rept. No. SAE-780168; 1978; 12P 1REF  
TECHNICAL PAPER SERIES. PRESENTED AT CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
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### DYNAMIC CORNERING PROPERTIES OF TIRES

STATIC AND DYNAMIC TIRE TESTS WERE CONDUCTED TO INVESTIGATE TIRE CORNERING PROPERTIES UNDER STEADY-STATE AND TRANSIENT CONDITIONS FOR DIFFERENT SLIP ANGLES. IN THE PAST THE EVALUATION OF TIRE CORNERING PROPERTIES HAS FREQUENTLY BEEN CONDUCTED USING ONLY STEADY-STATE PROPERTIES, AND IN A GREAT MANY CASES, THE THEORETICAL ANALYSIS OF VEHICULAR MOTION HAS BEEN PERFORMED USING THE RESULTS OF SUCH EVALUATION. HOWEVER, WHEN A VEHICLE IS TRAVELING THROUGH A GENERAL CURVILINEAR MOTION, THERE ARE CONTINUOUS CHANGES IN THE VERTICAL FORCE EXERTED ON THE TIRE BY THE GROUND, SLIP ANGLE, CAMBER ANGLE, TIRE FORWARD SPEED AND TIRE ANGULAR

SPEED DUE TO REVOLUTION. UNDER SUCH VARYING OPERATIONAL CONDITIONS, THE CORNERING PROPERTY VALUES WILL BE CONSIDERED TO DIFFER FROM THE STEADY-STATE TIRE CORNERING PROPERTIES. MEASUREMENTS WERE MADE OF FORCE AND MOMENT GENERATED AT THE TIRE-ROAD INTERFACE WHEN THE CHANGE IN SLIP ANGLE DUE TO TIRE-WHEEL STEERING WAS EXTREMELY LOW AND WHEN IT WAS RELATIVELY FAST. FOUR KINDS OF TIRES (BIAS-PLY, RADIAL (TEXTILE BELT), BELTED BIAS AND RADIAL (STEEL-BELTED)) WERE UTILIZED, AND THE RANGE OF SLIP ANGLE VARIATION WAS SET AT 0°-90° FOR STEADY-STATE CORNERING PROPERTIES AND 0°-15° FOR TRANSIENT TIRE CORNERING PROPERTIES. THEORETICAL CONSIDERATIONS ARE FIRST GIVEN FOR TRANSIENT TIRE CORNERING PROPERTIES WHEN SLIP ANGLE WAS SMALL, AND THEN EXPANDED TO INCLUDE CONSIDERATIONS OF TRANSIENT TIRE CORNERING PROPERTIES WHEN SLIP ANGLE WAS LARGE.

by TAKAHISA FURUICHI; HIDEO SAKAI  
JAPAN AUTOMOBILE RES. INST., INC. [JAPAN]  
Rept. No. SAE-780169; 1978; 19P 8REFS  
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### THE EFFECT OF HYDROPLANING ON THE DYNAMIC CHARACTERISTICS OF CAR, TRUCK AND BUS TIRES

THE EFFECT OF HYDROPLANING ON THE DYNAMIC CHARACTERISTICS OF CAR, TRUCK AND BUS TIRES WAS STUDIED USING THE INTERIOR SURFACE OF A DYNAMIC TIRE TESTING MACHINE. FOR CAR TIRES, THE RELATIONSHIPS BETWEEN BRAKING FORCE AND SLIP RATIO AND BETWEEN CORNERING FORCE AND SLIP ANGLE AS AFFECTED BY HYDROPLANING WERE INVESTIGATED. STUDIES WERE ALSO MADE OF THE INFLUENCE OF THE DIFFERENCE BETWEEN RADIAL-PLY AND CROSS-PLY TIRES, INNER PRESSURE, LOAD, THICKNESS OF THE WATER FILM, ETC. THE EFFECT OF HYDROPLANING ON THE CORNERING PROPERTIES WAS STUDIED FOR TRUCK AND BUS TIRES. IN SUMMARY, PASSENGER CAR RADIAL TIRES WERE FOUND TO HAVE GREATER RESISTANCE TO HYDROPLANING THAN CROSS-PLY TIRES WHEN THE WATER FILM WAS RELATIVELY THIN (1 MM), BUT THERE WAS ALMOST NO DIFFERENCE BETWEEN THE TWO TYPES OF TIRES WHEN THE WATER FILM WAS THICK (5 MM). IN THE CASE OF TRUCK AND BUS TIRES, THE TREAD PATTERN WAS FOUND TO EXERT AN EXTREMELY GREAT INFLUENCE ON THE SPEED AT WHICH HYDROPLANING OCCURRED. IF SUFFICIENT TREAD GROOVES REMAIN, THERE SHOULD BE NO PARTICULAR PROBLEMS WITH HYDROPLANING. IF HOWEVER, THE TREAD IS WORN, HYDROPLANING OCCURS AT SPEEDS CONSIDERABLY LOWER THAN THOSE INDICATED BY THE NASA EXPERIMENTAL HYDROPLANING EXPRESSION. THE SPEEDS AT WHICH THE WORN TIRES CAN BE OPERATED FALL

HS-022 609

SHARPLY, AND IT BECOMES EXTREMELY DANGEROUS FOR SUCH WORN TIRES TO BE USED AT HIGH SPEEDS.

by HIDEO SAKAI; OSAMU KANAYA; TAKUMI OKAYAMA  
JAPAN AUTOMOBILE RES. INST., INC. [JAPAN]  
Rept. No. SAE-780195; 1978; 24P 9REFS  
TECHNICAL PAPER SERIES. PRESENTED AT CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
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### THE USE OF THE MOBILE TIRE TRACTION DYNAMOMETER IN RESEARCH

THE MOBILE TIRE TRACTION DYNAMOMETER (MTTD) DESIGNED AND ASSEMBLED BY THE SAFETY RES. LAB. (SRL) OF THE NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION'S (NHTSA) TIRE SYSTEMS DIV. IS DESCRIBED AND EXPERIMENTAL RESULTS OF USING THIS TESTING DEVICE PRESENTED. THE MTTD MEASURES THE BRAKING AND CORNERING TRACTION OF PASSENGER CAR TIRES ON OUTDOOR PAVEMENTS AT HIGHWAY SPEEDS. ITS HYDROSTATIC WHEEL SPEED CONTROL SYSTEM, WHEEL LOADING AND POSITIONING SYSTEM, PAVEMENT WETTING SYSTEM, TRANSDUCERS, AND INSTRUMENTATION ARE DESCRIBED IN DETAIL. THE DATA PROCESSING METHODS FOR ITS SEVERAL TEST MODES ARE EXPLAINED. THIS RESEARCH TOOL HAS BEEN USED TO DETERMINE THAT MAXIMUM PEAK BRAKING COEFFICIENTS ON WET SURFACES ARE PRODUCED AT INTERMEDIATE SLIP RATES BETWEEN 36% AND 100% SLIP/SECOND, BUT THAT ON DRY SURFACES THE PEAK BRAKING COEFFICIENT INCREASES AS THE SLIP RATE DECREASES. IN ANOTHER EXPERIMENT, THE CHARACTERISTICS OF FILTERS WHICH AID IN THE PROCESSING OF PEAK BRAKING COEFFICIENT DATA HAVE BEEN IDENTIFIED. CORNERING EXPERIMENTS WITH THE MTTD INDICATE THAT THE PRINCIPAL EFFECT OF AN INCREASE IN SLIP ANGLE SWEEP RATE IS AN INCREASE IN THE SLIP ANGLE OFFSET. EXPERIMENTS TO INVESTIGATE VARIOUS PAVEMENT FRICTION TESTING METHODS INDICATE THAT PEAK BRAKING, LOCKED WHEEL BRAKING, CORNERING, AND BRAKING WITH CORNERING, DIFFER SIGNIFICANTLY IN THEIR SENSITIVITY TO CHANGES IN PAVEMENT SURFACE.

by P. L. BOYD; A. H. NEILL, JR.; JOHN HINCH  
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ADMINISTRATION, TIRE SYSTEMS DIV., RIVERDALE, MD.  
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### BASIC REQUIREMENTS FOR URBAN CARS

TO FIND THE MINIMUM RANGE, SPEED, AND CAPACITY REQUIRED TO MEET MOST NEEDS OF URBAN DRIVERS, ORIGIN-DESTINATION SURVEYS FROM LOS ANGELES AND THE WASHINGTON METROPOLITAN AREA WERE PROCESSED TO DETERMINE DRIVING PATTERNS FOR A TYPICAL DAY. THE SURVEY DATA INDICATE THAT RANGES SUFFICIENT FOR 95% OF DRIVING DAYS WOULD BE 75 KM FOR SECONDARY DRIVERS (DRIVER FROM A HOUSEHOLD WITH MORE THAN ONE DRIVER WHO REPORTED LESS TRAVEL ON THE SURVEY DAY THAN THE DRIVER REPORTING MOST TRAVEL AT THE HOUSEHOLD), 150 KM FOR ONLY DRIVERS (DRIVER AT HOUSEHOLD WITH ONLY ONE DRIVER ON THE SURVEY DAY), AND 225 KM FOR PRIMARY DRIVERS (DRIVER TRAVELING THE MOST AT A MULTIDRIVER HOUSEHOLD). SIMILARLY, SPEED ADEQUATE FOR FREEWAY USE IS REQUIRED TO SATISFY DRIVER NEEDS ON 95% OF DRIVING DAYS, WITH SEATING FOR AT LEAST TWO AND GENERALLY THREE PASSENGERS IN ADDITION TO THE DRIVER.

by WILLIAM HAMILTON  
GENERAL RES. CORP., SANTA BARBARA, CALIF.  
Rept. No. SAE-780219; 1978; 12P 14REFS  
TECHNICAL PAPER SERIES. PRESENTED AT CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR 1978.  
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### ON THE RELATIONSHIP BETWEEN GROSS VEHICLE WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST OF ELECTRIC VEHICLES

A GENERAL RELATIONSHIP AMONG EFFECTIVE RANGE, GROSS VEHICLE WEIGHT, PAYLOAD AND COST OF ELECTRICALLY POWERED VEHICLES EQUIPPED WITH ENERGY STORAGE UNITS OF DIFFERING CAPACITY (LEAD, TUBULAR PLATE BATTERY; LEAD, GRID PLATE BATTERY; NEW ALKALINE BATTERY) IS ESTABLISHED. THE DESIGN OF THE ENTIRE VEHICLE IS DECISIVELY INFLUENCED BY THE STORAGE CAPACITY OF THE ENERGY STORAGE UNIT. THE VEHICLE MAY BE EITHER DESIGNED FOR MAXIMUM EFFECTIVE RANGE, WHICH MEANS CUTTING DOWN ON THE PAYLOAD, OR, ALTERNATIVELY, INCREASING THE GROSS VEHICLE WEIGHT MORE THAN IS WARRANTED BY THE WEIGHT INCREASE OF THE BATTERIES, BECAUSE MORE BATTERY WEIGHT MEANS MORE CURB WEIGHT AS WELL. ON THE OTHER HAND, IT IS POSSIBLE TO SETTLE FOR A CERTAIN RANGE, CONCENTRATING ON KEEPING THE GROSS WEIGHT OF THE VEHICLE AS LOW AS POSSIBLE, WHILE ADHERING TO A CERTAIN GIVEN PAYLOAD. THIS WILL MAKE FOR A DROP IN THE OPERATING COST OF THE VEHICLE. FURTHERMORE, IT IS NOT NECESSARILY THE BATTERY SYSTEM WHICH HAS THE LOWEST PURCHASE PRICE WHICH GUARANTEES MINIMUM COST, FOR THE COST OF OPERATING AN ELECTRIC VEHICLE IS GREATLY INFLUENCED BY THE ENERGY DENSITY AND THE CYCLE LIFE OF ITS BATTERY AS WELL.

August 31, 1978

HS-022 613

VEHICLES EQUIPPED WITH NEW ALKALINE BATTERIES, WHICH ARE THREE TIMES AS EXPENSIVE AS GRID AND TUBULAR PLATE BATTERIES BUT FEATURE LONG CYCLE LIFE AND HIGH ENERGY DENSITY, MAY EVENTUALLY COST THE USER MUCH LESS TO OPERATE THAN VEHICLES OF THE SAME EFFECTIVE RANGE AND PAYLOAD EQUIPPED WITH BATTERIES OF LOWER CAPACITY AND SHORTER CYCLE LIFE.

by J. P. ALTENDORF; A. KALBERLAH; N. SARIDAKIS  
VOLKSWAGENWERK A.G., WOLFSBURG, GERMANY  
Rept. No. SAE-780220; 1978; 12P 6REFS  
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HS-022 612

#### **SOURCES OF ROLLING RESISTANCE IN RADIAL PLY TIRES**

THE BASIC MECHANICAL PROCESSES LEADING TO THE FORMATION OF THE ROLLING RESISTANCE OF RADIAL-PLY PNEUMATIC TIRES, SPECIAL TESTING PROCEDURES FOR ELUCIDATING THE CONTRIBUTIONS AND CHARACTERISTICS OF THESE MECHANICAL PROCESSES, AND AN ASSESSMENT OF THE RELATIVE CONTRIBUTIONS TO THE ROLLING RESISTANCE FROM VARIOUS MECHANISMS AND PARTS OF THE TIRE ARE CONSIDERED. QUANTITATIVELY, THE ROLLING RESISTANCE EQUALS THE MECHANICAL ENERGY CONVERTED INTO HEAT PER UNIT DISTANCE OF TRAVEL. THE ROLLING RESISTANCE IS FUNDAMENTALLY RELATED TO THE DEFLECTION AND TO THE INFLATION PRESSURE OF THE TIRE. THESE TWO VARIABLES TAKEN TOGETHER DETERMINE THE OPERATING LOAD BUT HAVE INDEPENDENT MECHANICAL CONSEQUENCES IN CONTRAST TO THE LOAD. EACH HAS ITS INDIVIDUAL INFLUENCE ON CERTAIN OF THE ASPECTS OF THE STRESS AND STRAIN CYCLES IN THE ROLLING TIRE. A SUMMARY OF EXPERIMENTAL DATA ON DEFLECTION-DEPENDENT AND INFLATION-DEPENDENT ROLLING RESISTANCE CONTRIBUTIONS (POUNDS OF ROLLING RESISTANCE AT 28 PSI AND 1.16 DEFLECTION) ATTRIBUTED TO VARIOUS PARTS OF THE TIRE IS AS FOLLOWS: BEAD, DEFLECTION-DEPENDENT AND INFLATION-DEPENDENT GREATER THAN 1.25; MID-SIDEWALL, DEFLECTION-DEPENDENT GREATER THAN 3.0 AND INFLATION-DEPENDENT GREATER THAN 0; BUTTRESS, DEFLECTION-DEPENDENT GREATER THAN 0.35 AND INFLATION-DEPENDENT GREATER THAN 0.35; CIRCUMFERENTIAL STRAINS, DEFLECTION-DEPENDENT 0 AND INFLATION-DEPENDENT 1.30; TREAD STRAINS, DEFLECTION-DEPENDENT APPROXIMATELY 0.94 AND INFLATION-DEPENDENT APPROXIMATELY 1.24; AND SLIDING FRICTION, DEFLECTION-DEPENDENT AND INFLATION-DEPENDENT LESS THAN 1.50. SIGNIFICANT AMOUNTS OF ELASTIC ENERGY ARE CONVERTED TO HEAT IN ALMOST ALL PARTS OF THE TIRE. REDUCING THE ROLLING RESISTANCE OF TIRES BY STRUCTURAL REDESIGN REQUIRES ATTENTION TO THE COUPLED

MECHANICAL ACTIONS TAKING PLACE IN ALL OF THESE REGIONS.

by S. A. LIPPMAN; K. L. OBLIZAJEK; J. J. METTERS  
UNIROYAL TIRE CO.  
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#### **TARGET IDENTIFICATION CAPABILITY OF SWEPT FREQUENCY AUTOMOBILE RADAR**

THEORETICAL AND EXPERIMENTAL RESULTS OF AN INITIAL STUDY OF X-BAND SWEPT FREQUENCY RADAR AS A MEANS OF TARGET DISCRIMINATION FOR AUTOMOTIVE RADAR ARE PRESENTED. THE PROSPECT OF USING RADAR AS A MEANS OF ANTICIPATING AN AUTOMOBILE COLLISION BY APPLYING IT TO SYSTEMS FOR DRIVER WARNING, AUTOMATIC BRAKING, AND DEPLOYMENT OF PASSIVE RESTRAINTS HAS BEEN DISCUSSED IN RECENT YEARS. SOME FORM OF TARGET DISCRIMINATION WILL BE REQUIRED IF SUCH SYSTEMS ARE TO BE PRACTICAL. A SIMPLE ANALYTICAL MODEL DEMONSTRATES THAT THE FREQUENCY DEPENDENCE OF RADAR RETURNS FROM AN OBJECT IS RELATED TO THE NUMBER AND POSITION OF ITS SCATTERING CENTERS. EXPERIMENTAL MEASUREMENTS SHOW THAT OBSTACLES SUCH AS OIL DRUMS AND ROAD SIGNS ARE SIMPLE TARGETS COMPRISED OF A SINGLE SCATTERING CENTER WHILE AUTOMOBILES ARE VERY COMPLEX TARGETS HAVING A LARGE NUMBER OF INTERACTING SCATTERING CENTERS. PRECEDING THIS INVESTIGATION, IT WAS THOUGHT THAT THE STRUCTURAL SIMILARITIES OF AUTOMOBILES (BUMPER, GRILLES, ETC.) WOULD PRODUCE COMMON FEATURES IN THEIR RESPECTIVE FREQUENCY RESPONSE MEASUREMENTS. HOWEVER, THE DATA HAVE INDICATED THAT THE SCATTERING CENTERS ARE ASSOCIATED WITH THE FINE STRUCTURAL DETAILS WHICH MAKE ONE TYPE OF AUTOMOBILE DIFFERENT FROM ANOTHER. ALSO, THE ANGLE AT WHICH THESE SCATTERING CENTERS ARE ILLUMINATED DETERMINES THE DEGREE TO WHICH THEY CONTRIBUTE TO THE OVERALL FREQUENCY RESPONSE. X-BAND SWEPT FREQUENCY RADAR HAS THE ABILITY TO DISTINGUISH BETWEEN SIMPLE AND COMPLEX TARGETS; HOWEVER, TARGETS POSING POTENTIALLY SERIOUS HAZARDS CANNOT BE DISTINGUISHED FROM THOSE WHICH DO NOT.

by JIMMY L. FUNKE  
GENERAL MOTORS RES. LABS.  
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### **COLLISION AVOIDANCE SYSTEM FOR AUTOMOBILES**

A COLLISION AVOIDANCE RADAR SYSTEM FOR AUTOMOBILES USES A TIME MAGNIFICATION PROCESS FOLLOWED BY DISCRIMINATION ACCORDING TO AMPLITUDE, PATTERN, AND ECHO JUMPS. IN ADDITION, THERE IS A RADAR RANGE LIMITATION WHICH IS DEPENDENT ON SPEED AND STEERING ANGLE. EXPERIMENTAL VEHICLES EQUIPPED WITH THE SYSTEM HAVE COVERED OVER 100,000 KM, AND THE RESULTS OF UTILIZATION OF THE COLLISION AVOIDANCE SYSTEM HAVE BEEN VERY ENCOURAGING.

by ERNST HERMANN DULL; HANS JOACHIM PETERS  
ROBERT BOSCH G.M.B.H., STUTTGART, GERMANY;  
AEG-TELEFUNKEN, MARKETING SECTION, ULM,  
GERMANY  
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### **AERODYNAMIC IMPROVEMENTS--A GREAT POTENTIAL FOR BETTER FUEL ECONOMY**

AERODYNAMIC IMPROVEMENTS IN FULL-SIZED AND SUBCOMPACT CARS ARE A MEANS OF OBTAINING BETTER FUEL ECONOMY. FIRST, GASOLINE-POWERED AND DIESEL-POWERED CARS ARE EVALUATED USING A COMPUTER SIMULATION TO PREDICT FUEL ECONOMY AND PERFORMANCE WITH AND WITHOUT INCORPORATION OF AERODYNAMIC IMPROVEMENTS. SECOND, THE METHODS ARE PRESENTED WHICH ENABLE SUCH IMPROVEMENTS TO BE REALIZED, ALONG WITH THE LIMITATIONS. THE POTENTIAL FOR FUEL ECONOMY INCREASES RESULTING FROM AERODYNAMIC IMPROVEMENTS IS SIGNIFICANT WHEN CONTRASTED WITH THE POTENTIALS FOR REDUCTION OF VEHICLE WEIGHT AND REDUCTION OF ENGINE HORSEPOWER. AN ACCEPTABLE DRAG COEFFICIENT OF 0.42 CAN BE READILY ACHIEVED WITHIN CONVENTIONAL STYLING CONCEPTS BY REFINING AND OPTIMIZING BODY DETAILS. DETAIL OPTIMIZATION CAN ENABLE GASOLINE-POWERED VEHICLES TO ACHIEVE MAXIMUM FUEL ECONOMY IMPROVEMENTS OF 4% AND 7% ABOVE 1977 AVERAGES FOR SUBCOMPACT AND FULL-SIZED PASSENGER CARS, RESPECTIVELY; AND DIESEL-POWERED VEHICLES TO ACHIEVE MAXIMUM FUEL ECONOMY IMPROVEMENTS OF 5% AND 9% FOR SUBCOMPACT AND FULL-SIZED PASSENGER CARS, RESPECTIVELY. CONTEMPORARY STYLING CONCEPTS PLACING GREATER EMPHASIS UPON AERODYNAMICS ENABLE A MINIMUM DRAG COEFFICIENT OF 0.32 TO BE ACHIEVED. APPLICATION OF SUCH CONCEPTS AND TECHNIQUES CAN ENABLE FUEL ECONOMY IMPROVEMENTS OF 14% (GASOLINE) AND 20% (DIESEL) FOR FULL-SIZED PASSENGER

CARS AND 11% (GASOLINE) AND 14% (DIESEL) FOR SUBCOMPACT CARS.

by L. J. JANSSEN; H.-J. EMMELMANN  
VOLKSWAGENWERK A.G., RES. AND DEVEL.,  
WOLFSBURG, GERMANY  
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### **ARE PEOPLE STILL GETTING BIGGER--WHO, WHERE, AND HOW MUCH? [DESIGN OF AUTOMOTIVE EQUIPMENT]**

IN VIEW OF IMPLICATIONS FOR THE DESIGN OF AUTOMOTIVE EQUIPMENT, THE TENDENCY TOWARDS AN INCREASINGLY LARGER BODY SIZE IN MANY HUMAN POPULATIONS IS DISCUSSED. THIS "SECULAR INCREASE" INVOLVES THE BODY AS A WHOLE, APPLIES TO BOTH MEN AND WOMEN, AND SEEMS TO AFFECT THE SHORT-STATURED MORE THAN THE TALL. SUMMARY ESTIMATES FOR THIS INCREASE IN STATURE HAVE AVERAGED AROUND 1.0 CM PER DECADE (OVER AT LEAST THE PAST CENTURY) ALTHOUGH THERE MAY BE CONSIDERABLE VARIABILITY BETWEEN STUDIES. THE MOST LIKELY EXPLANATIONS FOR THIS INCREASE INVOLVE IMPROVED ENVIRONMENTAL CONDITIONS SUCH AS BETTER NUTRITION, HEALTH CARE, AND SANITATION. SOME GROUPS CURRENTLY SHOW NO SECULAR INCREASE IN SIZE. THESE INCLUDE THOSE WHO LIVE IN ENVIRONMENTS WITH LESS THAN ADEQUATE DIETS AND MEDICAL CARE, OR THOSE WHO HAVE ALREADY ACHIEVED THEIR MAXIMUM BODY-SIZE POTENTIAL AS A RESULT OF LIVING IN OPTIMAL ENVIRONMENTS FOR GROWTH. THE SECULAR INCREASE IN SIZE IS LIKELY COMING TO AN END. AS MORE PEOPLE LIVE UNDER MORE FAVORED ENVIRONMENTAL CONDITIONS WHICH WILL ENABLE THEM TO ACHIEVE MAXIMUM GROWTH, THE RATE OF INCREASE WILL DECLINE. FUTURE CHANGES, AT LEAST IN TECHNOLOGICALLY DEVELOPED REGIONS, CAN BE PROJECTED AT A CONTINUALLY DECREASING RATE FROM THE FORMER HIGH OF ABOUT 1.0 CM PER DECADE.

by HOWARD W. STOUTD  
MICHIGAN STATE UNIV., DEPT. OF COMMUNITY  
MEDICINE  
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### **PASSIVE VEHICLE SAFETY AS CARS GROW SMALLER**

THEORETICAL AND EXPERIMENTAL CONSIDERATION IS GIVEN OF VARIOUS POSSIBILITIES OF INCREASING THE PASSIVE SAFETY OF PASSENGER CARS BY OPTIMIZING THE STRUCTURE AND



RESTRAINT SYSTEMS WHILE RETAINING THE VEHICLE SIZE, OR WHILE MAINTAINING THE SAME DEGREE OF PASSENGER PROTECTION, REDUCING THE VEHICLE SIZE. THE OBJECTIVE WAS TO FIND WAYS OF INCREASING THE PERMISSIBLE VELOCITY CHANGE OF A VEHICLE WHILE RETAINING A GIVEN DEFORMATION LENGTH, FORWARD DISPLACEMENT, AND PASSENGER LOADING, AND KEEPING THE PASSENGER COMPARTMENT DECELERATION NEARLY THE SAME. IT WAS ESTABLISHED BY MEANS OF THEORETICAL AS WELL AS EXPERIMENTAL METHODS THAT IT IS POSSIBLE, BASED ON THE DATA PRESENTED, TO INCREASE THE VELOCITY CHANGE FROM, FOR INSTANCE, 30 TO 40 MPH WITHOUT INCREASING THE LOADS ACTING ON THE PASSENGERS, WHILE THE DIMENSIONS OF THE VEHICLE AND THE DECELERATION OF THE PASSENGER COMPARTMENT REMAIN AS BEFORE. THE COSTS OF THE STEPS TAKEN, FOR INSTANCE, TO IMPROVE THE STRUCTURE AND RESTRAINT SYSTEM OF THE ESVW (EXPERIMENTAL SAFETY VOLKSWAGEN) II VEHICLE WERE QUITE CONSIDERABLE.

by H. SCHIMKAT; R. WEISSNER  
VOLKSWAGENWERK A.G.  
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#### CYBERMAN--A HUMAN FACTORS DESIGN TOOL

CYBERMAN, A COMPUTER MANIKIN FOR USE IN THE HUMAN FACTORS DESIGN OF AUTOMOBILES, IS A THREE-DIMENSIONAL FIGURE BASED ON A COMBINATION OF DIMENSIONS FROM THE SAE TWO-DIMENSIONAL MANIKIN AND OTHER HUMAN FACTORS SOURCES, AND IS STORED AS COMPUTER DATA. THE SUPPORT PROGRAMMING ALLOWS THE SEVERAL COMPONENTS (LIMBS, TRUNK, HEAD, ETC.) TO BE SIZED TO ANY DESIRED DIMENSION. INDIVIDUAL PEOPLE MAY THUS BE REPRESENTED IN THREE-DIMENSIONAL COMPUTER STUDIES BY ACCURATELY-PROPORTIONED MANIKINS. THIS GIVES DESIGN PERSONNEL THE POSSIBILITY OF FORECASTING THE REACTIONS OF REAL PEOPLE TO A DESIGN WHILE IT IS STILL IN THE FORMATIVE STAGE. THEY CAN ALSO COMPARE THESE REACTIONS TO THOSE INDICATED BY PERCENTILE ENVELOPES, AND PREPARE IN ADVANCE FOR CONSTRUCTIVE DESIGN DISCUSSIONS. FURTHER, THE DESIGNER'S DIMENSIONING ABILITY IS IMPROVED OVER CONVENTIONAL METHODS AS BOTH ORTHOGONAL AND SLANT-DISTANCE MEASUREMENTS ARE READILY OBTAINABLE IN THREE DIMENSIONS FROM THE COMPUTER. CONTROL DIMENSIONS MAY BE RAPIDLY ALTERED TO EVALUATE ALTERNATE CONDITIONS. THE FREQUENT USE OF THE COMPUTER MANIKIN BECOMES A MEANS TO EXPEDITE AND ACCELERATE THE PROCESS OF HUMAN FACTORS EVALUATION, BOTH THEORETICAL AND REAL-WORLD. AT PRESENT, 18 BONE-LINK AND OTHER DIMENSIONS ARE USED; THESE WILL BE SUBJECT TO REVISION FROM TIME TO TIME AS THE MANIKIN IS REDESIGNED FOR GREATER UTILI-

TY AND APPROPRIATE REALISM. THE END RESULT ANTICIPATED FROM THE USE OF THE CYBERMAN IS A REDUCTION IN THE NUMBER OF FULL-SIZE EVALUATION MOCK-UPS REQUIRED FOR A DESIGN PROGRAM.

by DANA WATERMAN; CLINTON T. WASHBURN  
CHRYSLER CORP., DESIGN OFFICE  
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#### TEST AND EVALUATION OF 23 ELECTRIC VEHICLES FOR STATE-OF-THE-ART ASSESSMENT

PERFORMANCE TESTS WERE CONDUCTED ON 23 ELECTRIC VEHICLES AS PART OF A PROGRAM TO CHARACTERIZE THE STATE OF THE ART OF ELECTRIC AND HYBRID VEHICLES (AS REQUIRED BY THE ELECTRIC AND HYBRID RES. DEVEL. AND DEMONSTRATION ACT OF 1976). THE TESTS SHOWED A WIDE VARIATION IN VEHICLE PERFORMANCE. THIS VARIATION IS ATTRIBUTED TO VEHICLE DESIGN DIFFERENCES AND THEIR INFLUENCES ON DRIVE-LINE EFFICIENCIES AND THE POWER REQUIRED TO PROPEL THE VEHICLES. THE RANGE, ACCELERATION, TOP SPEED, AND HILL CLIMBING PERFORMANCE FOR ELECTRIC VEHICLES WAS FOUND TO BE LOWER THAN FOR CONVENTIONAL VEHICLES. IMPROVEMENTS IN BATTERIES AND ELECTRIC DRIVE SYSTEMS, AS WELL AS THE USE OF ENERGY BUFFERS (SUCH AS FLYWHEELS) CAN SIGNIFICANTLY IMPROVE THE PERFORMANCE OF ELECTRIC VEHICLES, BUT THEY WILL PROBABLY ALWAYS HAVE SOME LIMITATIONS COMPARED TO CONVENTIONAL VEHICLES. THE ENERGY CONSUMPTION OF ELECTRIC AND CONVENTIONAL VEHICLES WAS FOUND TO BE ABOUT THE SAME. GASOLINE CONSUMPTION FOR FOUR CONVENTIONAL VEHICLES WAS MEASURED UNDER THE SAME TEST CONDITIONS AS WERE THE ELECTRIC VEHICLES. THE QUANTITIES OF THERMAL ENERGY IN THE GASOLINE USED TO PROPEL THE CONVENTIONAL VEHICLES IS APPROXIMATELY THE SAME AS WOULD BE USED TO PROPEL THE ELECTRIC VEHICLES. IMPROVEMENTS IN ELECTRIC VEHICLES SHOULD REDUCE ENERGY CONSUMPTION AND MAINTAIN OR IMPROVE THEIR ENERGY CONSUMPTION RELATIVE TO CONVENTIONAL VEHICLES. THE RELIABILITY OF THE ELECTRIC VEHICLES WAS POOR COMPARED TO CONVENTIONAL VEHICLES. AS THERE ARE PRESENTLY ELECTRIC VEHICLES IN SERVICE THAT HAVE DEMONSTRATED VERY HIGH RELIABILITY, IT IS EXPECTED THAT AS THE INDUSTRY MATURES THE RELIABILITY OF ALL ELECTRIC VEHICLES WILL IMPROVE.

by MILES O. DUSTIN; ROBERT J. DENINGTON  
NATIONAL AERONAUTICS AND SPACE  
ADMINISTRATION, LEWIS RES. CENTER,  
CLEVELAND, OHIO  
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# PARAMETERS FOR THE USE OF DISC BRAKES INCORPORATING AUTOMATICALLY ADJUSTED HANDBRAKE MECHANISMS

THE BASIC PARAMETERS WHICH HAVE TO BE CONSIDERED IN THE DESIGN AND DEVELOPMENT OF DISC BRAKES INCORPORATING AUTOMATICALLY ADJUSTED HANDBRAKE MECHANISMS ARE DISCUSSED. THE OBJECTIVE OF AN AUTOMATIC ADJUSTER INCORPORATED IN A DISC HANDBRAKE MECHANISM IS TO CONTROL THE CLEARANCE BETWEEN DISCS AND PADS ON THE VEHICLE WITH WEAR OF THE FRICTION MATERIAL DURING SERVICE IN ORDER TO PROVIDE THE DRIVER WITH A PROPERLY FUNCTIONING HANDBRAKE, WITHOUT EXCESSIVE HAND LEVER TRAVEL, READY, WHENEVER NEEDED. BEFORE DISCUSSING THE CONSTRUCTION AND PERFORMANCE OF THE BRAKE SYSTEMS THEMSELVES, THE PERFORMANCE REQUIREMENTS (EUROPEAN) OF THE BRAKES ARE OUTLINED AND THE INTERCONNECTIONS OF THE HAND LEVER AND THE WHEEL BRAKE WHICH VEHICLE MANUFACTURERS USUALLY PROVIDE ARE DISCUSSED. THE IDEAL SOLUTION FOR A DISC BRAKE WITH HANDBRAKE IS PROVIDED BY A SLIDING FIST-TYPE SERVICE BRAKE CALIPER WITH FULLY BOOTED SLIDES HAVING AN INTEGRAL, AUTOMATICALLY ADJUSTED HANDBRAKE. THE BASIC PROBLEMS WHICH EXIST IN THE PRESENT BRAKE DISC HANDBRAKES CAN ONLY BE SOLVED IF THE DIRECTION OF FUTURE DEVELOPMENTS MEETS THE FOLLOWING OBJECTIVES: FRICTION COEFFICIENT 0.4 AND ABOVE, WITH MATERIALS WHICH WILL MEET SPECIFIC TEST CONDITIONS (THERMAL EXPANSION 0.15 UP TO 400° C PAD SURFACE TEMPERATURE, NO RESIDUAL SWELL; COMPRESSIBILITY 0.01 MM AT AMBIENT TEMPERATURE, 0.02 MM UP TO 400° C (BOTH VALUES MEASURED ON NEW BEDDED PADS WITH A SPECIFIC PRESSURE OF 100 KP/SQ CM); AND STICKING EFFECT BETWEEN PAD AND DISC 0.3 MKP SHEAR LOAD PER PAD, OR 0.6 MKP SHEAR LOAD PER BRAKE); IMPROVED EFFICIENCY OF THE LOAD TRANSMISSION SYSTEM BETWEEN HAND AND CALIPER, POSSIBLY INCORPORATING FAVORABLE VARIABLE VELOCITY RATIO CHANGES; AND SINGLE-SIDED, FIST-TYPE CALIPERS (INCORPORATING FULLY BOOTED SLIDES) WITH MAXIMUM POSSIBLE STIFFNESS AND MAXIMUM ACHIEVABLE INTERNAL MECHANICAL BRAKE ADVANTAGE (REDUCING THE LOADS TAKEN BY THE BRAKE CABLES).

by H. RATH; S. MICKE; P. W. BROWN  
GIRLING CONTINENTAL OPERATIONS; GIRLING UK  
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# DYNAMIC SIMULATION OF AN AUTOMOBILE BODY UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS TECHNIQUES

ANALYTICAL TECHNIQUES FOR DEVELOPING A COST-EFFECTIVE COMPUTER MODEL TO ASSIST THE ENGINEER IN UNDERSTANDING THE DYNAMIC BEHAVIOR OF AN AUTOMOTIVE BODY STRUCTURE AND THE EFFECT OF THE VARIOUS COMPONENTS UPON THAT BEHAVIOR ARE PRESENTED. EMPHASIS IS PLACED ON COMPONENT MODELING CONSIDERATIONS AND THE ANALYTICAL COUPLING OF THE COMPONENTS INTO AN OVERALL SYSTEM MODEL OF THE BODY. THE TECHNOLOGY PRESENTED MAY BE EXTENDED TO DYNAMIC MODELING OF OTHER SHEET METAL STRUCTURES, SUCH AS TRUCK OR CONSTRUCTION EQUIPMENT CABS, ETC. THE DEVELOPMENT OF THE TOTAL BODY SYSTEM MODEL IS BASED ON THE BUILDING BLOCK APPROACH (BBA) OF MATHEMATICALLY COMBINING MODAL OR FINITE-ELEMENT REPRESENTATIONS OF THE BODY COMPONENTS. THE UNDERLYING PHILOSOPHY OF THE BBA IS TO DIVIDE THE SYSTEM UNDER CONSIDERATION INTO SEPARATE COMPONENTS WHICH ARE ANALYZED INDIVIDUALLY. THE RESULTING DYNAMIC CHARACTERISTICS OF THESE COMPONENTS PROVIDE MUCH DESIGN INSIGHT INTO THE DYNAMICS OF COMPONENTS WITH, ADDITIONALLY, THE ABILITY TO ISOLATE THESE DYNAMIC CHARACTERISTICS OF INTEREST ON THE RATIONAL BASIS OF FREQUENCY DISCRIMINATION. HOWEVER, THE MAIN CONSIDERATIONS LIE IN THE BEHAVIOR OF THE COMPONENTS AS A SYSTEM. AN EXAMPLE OF A VEHICLE BODY IS PRESENTED TO ILLUSTRATE THE APPROACH, AND THE ADEQUACY OF THE MODEL WAS VERIFIED THROUGH A VARIETY OF CORRELATION STEPS. IN PARTICULAR, THIS ANALYTICAL TOOL OFFERS THE DESIGN ENGINEER THE ABILITY TO STUDY ANIMATED MODE SHAPES AND MODAL STRAIN ENERGY TO OBTAIN CERTAIN INFORMATION REGARDING VARIOUS BODY COMPONENTS AND OTHER COMPONENTS IN THE COMPLETE VEHICLE. AREAS OF EXCESSIVE MOTION OR WEAKNESS CAN BE IDENTIFIED AND INSIGHT INTO POSSIBLE FIXES MAY BE OBTAINED. BY DETERMINING STRAIN ENERGY IN AND TRANSMISSIBILITY THROUGH BODY MOUNTS FOR VARIOUS MOUNT LOCATIONS, THE OPTIMAL MOUNT LOCATIONS AND THE DESIGN DATA FOR THE MOUNTS AND CHASSIS COMPONENTS CAN BE DETERMINED. COMPONENT INTERACTIONS CAN ALSO BE OBSERVED AND THE DESIGNER CAN STUDY AND CORRECT UNDESIRABLE INTERACTIONS. VEHICLE RIDE STUDIES CAN ALSO BE PERFORMED, AND THE TOTAL VEHICLE MODEL CAN BE ALTERED AND EXERCISED TO OPTIMIZE THE RIDE QUALITY.

by GARY E. TOWNLEY; JOSEPH W. KLAHS  
STRUCTURAL DYNAMICS RES. CORP.  
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### ENERGY ABSORPTION BY THE PLASTIC DEFORMATION OF BODY STRUCTURAL MEMBERS

IN ORDER TO STUDY THE CRASHWORTHINESS OF THE AUTOMOBILE, CALCULATIONS OF THE MAXIMUM COMPRESSIVE LOAD AND MEAN CRUSH LOAD WERE MADE FOR SHEET METAL MEMBERS WITH CLOSED-HAT SECTION AND FLANGES OR WALLS ATTACHED TO THEM. THIS TYPE OF STRUCTURAL MEMBER WAS CHOSEN BECAUSE IT CONTRIBUTES TO MAJOR COLLISION ENERGY ABSORPTION IN THE CASE OF CARS WITH UNIBODY CONSTRUCTION. FOR MATERIALS, SUCH AS MILD STEEL, THE EFFECT OF THE STRAIN RATE ON THE YIELD POINT CANNOT BE NEGLECTED. THEREFORE, THE CORRELATIONS BETWEEN THE STATIC COMPRESSIVE LOADS AND THE DYNAMIC COMPRESSIVE LOADS FOR THESE MEMBERS WERE DETERMINED EXPERIMENTALLY BY THE STRESS-STRAIN RELATIONSHIP INCLUDING STRAIN RATE SENSITIVITY. FURTHER, COMPARISONS WERE MADE BETWEEN THE RESULTS OF CALCULATING THE CRUSH CHARACTERISTICS OF THE VEHICLE STRUCTURES BY A MATHEMATICAL MODEL USING THE CALCULATED COMPRESSIVE LOADS OF THE MEMBERS AS INPUT, AND THE RESULTS OF ACTUAL BARRIER TESTS. THE RESULTS SHOWED GOOD AGREEMENT, VERIFYING THE EFFECTIVENESS OF THE THEORETICAL ANALYSIS.

by MASANORI TANI; AKIO FUNAHASHI  
MITSUBISHI MOTORS CORP. [JAPAN]  
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### A COMPARISON OF ADVANCED BELT SYSTEMS REGARDING THEIR EFFECTIVENESS

A COMPARISON OF THE EFFECTIVENESS OF FOUR ADVANCED PASSENGER RESTRAINT BELT SYSTEMS IS PRESENTED. THE FOLLOWING BELT SYSTEMS WERE EVALUATED: SYSTEM A, A THREE-POINT-BELT SYSTEM WHICH IS EQUIPPED WITH A PRELOADING DEVICE AND A BELT FORCE LIMITER; SYSTEM B, COMBINATION OF A SHOULDER BELT AND A KNEE BOLSTER, EQUIPPED WITH A PRELOADING DEVICE AND A BELT FORCE LIMITER; SYSTEM C, COMBINATION OF A SHOULDER BELT AND A KNEE BOLSTER, EQUIPPED WITH A FORCE LIMITER; AND SYSTEM D, COMBINATION OF A SHOULDER BELT AND A KNEE BOLSTER. THE SYSTEMS WERE TESTED IN SLED TESTS SIMULATING FRONTAL CRASHES UP TO 40 MPH IMPACT SPEED AGAINST A FIXED BARRIER AND A MAXIMUM SLED DECELERATION OF APPROXIMATELY 27 G, WHICH ARE EXTREMELY SEVERE TEST CONDITIONS. RESULTS OF THE TESTS SHOW THAT THE OPERABILITY OF A BELT SYSTEM CAN BE POSITIVELY INFLUENCED BY COMPONENTS SUCH AS BELT FORCE LIMITERS AND PRELOADING DEVICES. AN EVALUATION INDEX EI IS INTRODUCED, A MATHEMATICAL FORMULA

WHICH INCLUDES INDIVIDUAL EVALUATION VARIABLES SUCH AS HIC (HEAD INJURY CRITERION), SI (SEVERITY INDEX), FORCES AND DISPLACEMENTS. THE INDIVIDUAL EVALUATION VARIABLES ARE WEIGHTED SINCE EACH VARIABLE DOES NOT INVOLVE THE SAME RISK OF INJURY. USING THE EI, THE EFFECTS OF THE VARIOUS SYSTEM PARAMETERS ON THE EFFECTIVENESS OF A CERTAIN OCCUPANT RESTRAINT SYSTEM CAN BE MADE CLEAR. IN ADDITION, THE EI PERMITS THE COMPILATION OF AN EFFECTIVENESS CLASSIFICATION OF VARIOUS OCCUPANT RESTRAINT SYSTEMS. THE EFFECT OF VARIOUS SYSTEM PARAMETERS ON THE EI FOR THREE SYSTEMS (B, C, D) IS SHOWN, AND AN EFFECTIVENESS CLASSIFICATION OF TWO SYSTEMS (A AND B) IS GIVEN WHICH IS MERELY AN EXAMPLE FOR THE APPLICABILITY OF THE EI.

by RUDIGER WEISSNER  
VOLKSWAGENWERK A.G., RES. AND DEVEL.  
[GERMANY]  
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### DESIGN CONSIDERATIONS IN ENERGY ABSORPTION BY STRUCTURAL COLLAPSE

A GENERAL TREATMENT OF THE ABSORPTION OF MECHANICAL ENERGY BY THE AXIAL COLLAPSE OF A VARIETY OF STRUCTURAL SHAPES, INCLUDING TUBES, HONEYCOMBS, AND FOAMS IS DEVELOPED WHICH ENCOMPASSES BOTH THE GEOMETRY OF THE STRUCTURE AND ALSO THE MATERIAL PROPERTIES. THE USE OF THE METHOD IN THE DESIGN OF LOAD-BEARING STRUCTURES IN WHICH ENERGY ABSORPTION IS AN ADDITIONAL DESIGN FUNCTION IS ILLUSTRATED. HIGH STRENGTH-TO-WEIGHT RATIO MATERIALS OFFER A SIGNIFICANT WEIGHT SAVING FOR ENERGY-ABSORBING MATERIALS. SPECIFIC ULTIMATE STRENGTH PLAYS A CRUCIAL ROLE IN AXIAL ENERGY ABSORPTION.

by C. L. MAGEE; P. H. THORNTON  
FORD MOTOR CO., RES. STAFF, DEARBORN, MICH.  
Rept. No. SAE-780434; 1978; 18P 21REFS  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 625

### VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT

FIELD ACCIDENT PERFORMANCE OF VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT SYSTEM, VWRA, INSTALLED IN RABBIT VEHICLES OPERATING IN THE U.S. WAS EVALUATED. THE HISTORICAL DEVELOPMENT OF THE VWRA AS AN OUTGROWTH OF VW'S RESEARCH AND

DEVELOPMENT PROGRAMS IS OUTLINED FIRST. THE STUDY COLLECTED AND ANALYZED DATA ON 70 ACCIDENTS INVOLVING THE RABBIT VEHICLE EQUIPPED WITH THE VWRA SYSTEM. PARAMETERS MEASURED AND PRESENTED ARE VEHICLE REPAIR COSTS, VDI (VEHICLE DEFORMATION INDEX), EBV (EQUIVALENT BARRIER VELOCITY), OIS/AIS (ABBREVIATED INJURY SCALE), OCCUPANT CONTACT POINTS, AND SOME COLLISION DATA INVOLVING CRASH RECORDERS PROVIDED BY THE NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION (NHTSA). SPECIFIC AREAS OF INTEREST ARE EXPLORED SUCH AS FREQUENCY/SEVERITY OF INJURY TO KNEE-FEMUR COMPLEX, THE HEAD, AND THE THORAX. TO ACT AS A BASELINE, RESULTS OF DYNAMIC SLED AND FULL-SCALE BARRIER CRASH TESTING WITH INSTRUMENTED SURROGATES USING THE VWRA ARE PRESENTED. THE RESULTS OF THIS PRELIMINARY, BASICALLY CLINICAL STUDY LEAD ONE TO BE OPTIMISTIC THAT THE VWRA SYSTEM IS BOTH AS RELIABLE AND AS EFFECTIVE IN THE FIELD AS ANTICIPATED, AND CONFIRMATORY OF EVALUATIONS CONDUCTED UNDER CONTROLLED REPRODUCEABLE TEST CONDITIONS. NO FATALITIES OR AIS 4 OR 5 INJURIES HAVE BEEN FOUND ASSOCIATED WITH USE OF THE VWRA TO DATE. A SEARCH OF THE FATAL ACCIDENT REPORTING SYSTEM (FARS) HAS NOT SHOWN ANY FRONT-SEAT FATALITY WHEN THE TORSO BELT HAS BEEN IN POSITION.

by S. R. MILLER; U. W. SEIFFERT; J. D. STATES  
VOLKSWAGENWERK A.G., RES. AND DEVEL.,  
WOLFSBURG, GERMANY; ROCHESTER GENERAL  
HOSP., DEPT. OF ORTHOPEDICS  
Rept. No. SAE-780436; 1978; 16P 3REFS  
TECHNICAL PAPER SERIES. PRESENTED AT  
CONGRESS AND EXPOSITION, DETROIT, 27 FEB-3 MAR  
1978.  
Availability: SAE

HS-022 626

### PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY

FIFTEEN ARTICLES COVER THE SUBJECT AREAS OF PEDESTRIAN SAFETY, BICYCLE TRANSPORTATION, DRIVER TRAINING, AND SYSTEM-SAFETY TECHNIQUES. SIGNAL PHASING AND SIGNAL DISPLAYS FOR PEDESTRIANS, KNOWLEDGE AND PERCEPTIONS OF YOUNG PEDESTRIANS, AN ACCIDENT DATA BASE FOR URBAN PEDESTRIANS AND A METHOD FOR ESTIMATING PEDESTRIAN VOLUME IN A BUSINESS DISTRICT ARE DISCUSSED. A CASE STUDY OF BICYCLE TRANSPORTATION FOR DOWNTOWN WORK TRIPS IS PRESENTED, FOLLOWED BY CONSIDERATION OF CITIZEN PARTICIPATION IN PLANNING AND DESIGNING BIKEWAYS, A METHOD FOR EVALUATING THE IMPACT OF WEATHER ON BICYCLE USE, DEVELOPMENT OF A BICYCLE ACCIDENT RATE IN ARIZONA, AND THE EFFECT OF BICYCLE LANE USAGE ON VEHICLES IN THE ADJACENT LANE. THREE ARTICLES CONSIDER THE EFFECTIVENESS OF DRIVER TRAINING PROGRAMS. EXISTING SYSTEM SAFETY TECHNIQUES

ARE REVIEWED, AND MODIFICATIONS SUGGESTED FOR USE IN TRANSPORTATION SAFETY STUDIES.

NATIONAL ACAD. OF SCIENCES, TRANSPORTATION  
RES. BOARD, WASHINGTON, D.C.  
Rept. No. TRR-629; 1977; 91P REFS  
INCLUDES HS-022 627--HS-022 641.  
Availability: CORPORATE AUTHOR \$3.60

HS-022 627

### SELECTION OF PEDESTRIAN SIGNAL PHASING

A METHODOLOGY IS PRESENTED FOR SELECTING ALTERNATE SCHEMES FOR PEDESTRIAN SIGNAL PHASING. TYPES OF PHASING STUDIED INCLUDE COMBINED PEDESTRIAN-VEHICLE INTERVAL, EARLY RELEASE OF PEDESTRIANS WITH RESPECT TO VEHICLES, LATE RELEASE OF PEDESTRIANS WITH RESPECT TO VEHICLES, AND SCRAMBLE TIMING. EACH ALTERNATIVE IS WEIGHED IN TERMS OF ITS IMPACT ON THE SAFETY OF THE PEDESTRIAN AND ON THE DELAY TO BOTH PEDESTRIANS AND VEHICLES. THE COMBINED PEDESTRIAN-VEHICLE INTERVAL WILL ALMOST ALWAYS MINIMIZE OVERALL PEDESTRIAN AND VEHICLE DELAY. THE ONLY EXCEPTION IS THE CASE IN WHICH A PEDESTRIAN-VEHICLE CONFLICT CAUSES LONG QUEUES OF VEHICLES TO FORM IN A RIGHT-TURNING LANE (OR LEFT-TURNING LANE ON A ONE-WAY STREET). IN THAT CASE, THE USE OF LATE RELEASE OR SCRAMBLE TIMING IS PREFERABLE. SCRAMBLE TIMING CAN INCREASE PEDESTRIAN SAFETY BY COMPLETELY SEPARATING PEDESTRIAN AND VEHICULAR MOVEMENTS; HOWEVER, THIS BENEFIT IS CANCELED IF PEDESTRIAN COMPLIANCE IS LOW. THE EARLY RELEASE OF PEDESTRIANS DOES NOT APPEAR TO SIGNIFICANTLY IMPROVE PEDESTRIAN SAFETY AND WILL ALWAYS INCREASE TOTAL DELAY AT THE INTERSECTION. A METHODOLOGY FOR SELECTING THE PHASING FOR GIVEN PEDESTRIAN VOLUMES AND VEHICLE-TURNING MOVEMENTS IS PRESENTED.

by C. M. ABRAMS; S. A. SMITH  
JHK AND ASSOCIATES, ALEXANDRIA, VA.  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS,  
BICYCLE FACILITIES, DRIVER RESEARCH, AND  
SYSTEM SAFETY," WASHINGTON, 1977 P1-6  
1977; 3REFS  
WORK PERFORMED UNDER CONTRACT ENTITLED  
"URBAN INTERSECTION IMPROVEMENTS FOR  
PEDESTRIAN SAFETY" SPONSORED BY FEDERAL  
HWY. ADMINISTRATION.  
Availability: IN HS-022 626

HS-022 628

### PEDESTRIAN DELAY AND PEDESTRIAN SIGNAL WARRANTS

PEDESTRIAN DELAY IS USED AS THE BOUNDARY CRITERION IN TRAFFIC SIGNAL WARRANTS. PREVIOUSLY DEVELOPED ANALYTICAL FORMULATIONS ARE EXAMINED AND FOUND TO BE INADEQUATE. THE DEVELOPMENT OF A RATIONAL PEDESTRIAN WARRANT SHOULD BE BASED ON AN ACCEPTABLE LEVEL OF AVERAGE PEDESTRIAN DELAY, A

August 31, 1978

HS-022 631

TOLERABLE LEVEL OF MAXIMUM, I.E. 95TH PERCENTILE, PEDESTRIAN DELAY, AND AN EQUITABLE ALLOCATION OF TOTAL DELAY BETWEEN THE PEDESTRIAN AND VEHICLE COMPONENTS OF THE TRAFFIC STREAM. IN DEVELOPING THE WARRANT, 30S WAS SELECTED AS AN ACCEPTABLE LEVEL OF MEAN PEDESTRIAN DELAY AND 60S AS A TOLERABLE LEVEL OF MAXIMUM DELAY. PEDESTRIAN BEHAVIOR PATTERNS WERE CONSIDERED IN RELATION TO DIVIDED AND UNDIVIDED HIGHWAYS AND WARRANTS PROPOSED FOR BOTH TYPES.

by G. F. KING

KLD ASSOCIATES, INC., HUNTINGTON STATION, N.Y.  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY," WASHINGTON, 1977 P7-13

1977; 10REFS

SPONSORED BY AMERICAN ASSOC. OF STATE HWY. AND TRANSPORTATION OFFICIALS IN COOPERATION WITH FEDERAL HWY. ADMINISTRATION.

Availability: IN HS-022 626

HS-022 629

#### **KNOWLEDGE AND PERCEPTIONS OF YOUNG PEDESTRIANS**

A SCHOOL WALKING-TRIP STUDY WAS CONDUCTED TO DEVELOP GUIDELINES FOR THE PROTECTION OF YOUNG PEDESTRIANS (5 TO 14 YEARS) WALKING TO AND FROM SCHOOL. THE GUIDELINES WERE BASED ON FIELD SURVEYS OF THE YOUNG PEDESTRIAN AND THE DRIVER REGARDING DESIGNATED SCHOOL ZONES AND SPECIFIC SCHOOL-CROSSING PROTECTIVE DEVICES. NATIONAL AND URBAN ACCIDENT DATA WERE ANALYZED, AND THE CHARACTERISTICS OF ACTIVITIES OF THOSE INVOLVED IN SCHOOL WALKING-TRIP ACCIDENTS. DATA COLLECTED ON 933 STUDENTS IN URBAN, SUBURBAN, AND RURAL SCHOOLS COMPARED GROUPS BY LOCATION, GRADE, AND SEX, AND FOUND THE PATTERN OF RESPONSES INDICATING A PROGRESSION IN UNDERSTANDING AND PEDESTRIAN CAPABILITY FROM THE KINDERGARTEN TO EIGHTH GRADE STUDENTS. A SPECIAL FIELD STUDY WAS CONDUCTED TO VERIFY THE FINDINGS CONCERNING TRAFFIC SIGNALS. MORE YOUNGER CHILDREN THEN OLDER WERE WILLING TO CHANGE THEIR ROUTE IF TOLD TO DO SO BY THEIR PARENTS, SUGGESTING THAT WHILE PARENTS MAY BE THE MOST USEFUL CHANNEL OF INFORMATION FOR THE YOUNGER CHILDREN, THE PEER GROUP MAY HAVE MORE INFLUENCE ON THE OLDER ONES. A BROAD SAFETY PROGRAM INVOLVING TRAFFIC ENGINEERS, PARENTS, EDUCATORS, POLICE, PTA, AND THE MEDIA IS RECOMMENDED.

by MARTIN L. REISS

BIOTECHNOLOGY, INC., FALLS CHURCH, VA.  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY," WASHINGTON, 1977 P13-9

1977; 17REFS

Availability: IN HS-022 626

HS-022 630

#### **PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION OF WORD MESSAGE AND OPERATION**

IN A STUDY OF THE EFFECTIVENESS OF PEDESTRIAN SIGNAL DISPLAYS, THREE EXPERIMENTAL CONDITIONS WERE DEVISED AND COMPARED TO THE CURRENT RECOMMENDED MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) STANDARD. PEDESTRIAN BEHAVIOR, COMPLIANCE, AND USER UNDERSTANDING WERE MEASURED, AND A STATISTICAL COMPARISON MADE CONTRASTING THE EXPERIMENTAL AND STANDARD SIGNAL. EXPERIMENT 1 COMPARED A STEADY DON'T WALK (DW) CLEARANCE INDICATION TO THE STANDARD FLASHING DON'T WALK (FDW) SIGNAL; EXPERIMENT 2 TESTED A DON'T START (DS) MESSAGE INSTEAD OF THE DW MESSAGE; EXPERIMENT 3 COMPARED STEADY WALK TO FLASHING WALK. CONCLUSIONS WERE THAT A STEADY DW CLEARANCE DISPLAY SEEMS TO HAVE THE SAME EFFECTIVENESS AS AN FDW CLEARANCE DISPLAY, WITHOUT SUFFICIENT EVIDENCE TO SAY THAT A STEADY CLEARANCE IS BETTER THAN A FLASHING CLEARANCE. THE DON'T START MESSAGE OFFERS LITTLE OR NO IMPROVEMENT OVER THE CURRENT DW MESSAGE. FLASHING WALK IS NOT AN EFFECTIVE MEANS OF WARNING PEDESTRIANS ABOUT TURNING VEHICLES (TVS); THERE IS A NEED TO MAKE PEDESTRIANS MORE AWARE OF TVS. PEDESTRIANS' OBSERVANCE OF SIGNALS VARIES SOMEWHAT FROM INTERSECTION TO INTERSECTION AND GREATLY FROM CITY TO CITY. THE PEDESTRIAN BEHAVIORS USED MAY BE SENSITIVE ENOUGH TO REFLECT THE RESPONSES OF PEDESTRIANS TO THE SUBTLE CHANGES MADE IN THESE EXPERIMENTS.

by H. DOUGLAS ROBERTSON

BIOTECHNOLOGY, INC., FALLS CHURCH, VA.  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY," WASHINGTON, 1977 P19-22

1977; 3REFS

Availability: IN HS-022 626

HS-022 631

#### **A METHOD FOR ESTIMATING PEDESTRIAN VOLUME IN A CENTRAL BUSINESS DISTRICT**

A SIMPLE QUANTITATIVE MODEL WAS DEVELOPED FOR PREDICTING THE PEDESTRIAN VOLUME FROM LAND USE DATA IN THE CORE OF THE CENTRAL BUSINESS DISTRICT (CBD). AS THE RELATION BETWEEN PEDESTRIAN TRAFFIC AND INFLUENCING VARIABLES CAN BEST BE STUDIED BY QUANTITATIVE ANALYSIS, A NUMBER OF INDEPENDENT VARIABLES WERE CHOSEN: COMMERCIAL SPACE, OFFICE, CULTURAL AND ENTERTAINMENT, MANUFACTURING, RESIDENTIAL, PARKING, STORAGE AND MAINTENANCE, AND VACANT SPACE; THE PEDESTRIAN VOLUME PER HOUR PER BLOCK WAS THE DEPENDENT VARIABLE USED FOR DEVELOPING THE PROPOSED MODELS. A STEPWISE REGRESSION TECHNIQUE WAS USED TO DISCRIMINATE AND ENTER INTO THE MODEL THE MOST SIGNIFICANT

LAND USE VARIABLES THAT INFLUENCED THE PEDESTRIAN VOLUME. STATISTICAL EVALUATION OF THE TWO MODELS, NOON-HOUR PEDESTRIAN VOLUME AND AVERAGE PEDESTRIAN VOLUME PER HOUR, INDICATED THAT THEY WERE GOOD PREDICTORS OF PEDESTRIAN VOLUME AND WILL PROVIDE RELATIVELY ACCURATE RESULTS. THE DATA COLLECTION PROCEDURE EMPLOYED, THOUGH LESS SOPHISTICATED THAN OTHER PROCEDURES, IS ECONOMICALLY FEASIBLE AND PROVIDES FOR REASONABLY ACCURATE INPUTS FOR USE IN THE MODELS. THE LAND USE DATA NEEDED FOR FORECASTING PURPOSES CAN BE OBTAINED FROM CITY PLANNING AGENCIES WITHOUT SIGNIFICANT DIFFICULTY OR COST IN MANY U.S. CITIES. THE MODELS HAVE A WIDE RANGE OF APPLICATIONS IN THE FIELD OF TRANSPORTATION ENGINEERING SUCH AS PLANNING, TRAFFIC ENGINEERING, AND DESIGN OF PEDESTRIAN FACILITIES. AS THE MODELS DEVELOPED WERE BASED ON THE DATA COLLECTED IN MILWAUKEE, A MEDIUM-SIZED CITY, THE WALKING HABITS, DEGREE OF TRANSIT USAGE, COMPOSITION OF LAND USE AND OTHER FACTORS MAY GENERATE A DIFFERENT FORMAT OF PEDESTRIAN MODELS IN OTHER CITIES. FURTHER RESEARCH IN LOW-DENSITY AND HIGH-DENSITY AREAS AND SMALL AND LARGE CITIES IS RECOMMENDED.

by JAHANBAKHSH BEHNAM; BHARAT G. PATEL  
MARQUETTE UNIV., DEPT. OF CIVIL ENGINEERING;  
SPICER ENGINEERING CO., SAGINAW, MICH.  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS,  
BICYCLE FACILITIES, DRIVER RESEARCH, AND  
SYSTEM SAFETY," WASHINGTON, 1977 P22-6  
1977; 4REFS  
Availability: IN HS-022 626

HS-022 632

#### ACCIDENT DATA BASE FOR URBAN PEDESTRIANS

A PEDESTRIAN ACCIDENT DATA SYSTEM WAS OPERATED IN SEVEN CITIES FROM 1973 THROUGH 1975, AND THE RESULTING DATA BASE USED TO EVALUATE THE EFFECTIVENESS OF VARIOUS COUNTERMEASURES THAT REDUCE THE OCCURRENCE OF SPECIFIC ACCIDENT TYPES IN A PRE-EXPERIMENTAL-CONTROL AND POST-EXPERIMENTAL-CONTROL PARADIGM. THE DATA INCLUDE A COMBINATION OF ITEMS ALREADY ON THE POLICE ACCIDENT REPORT FORM AND ADDITIONAL ITEMS NEEDED TO DETERMINE EACH ACCIDENT TYPE. ALL ACCIDENTS WERE CODED BOTH MANUALLY AND BY MACHINE, PROVIDING BOTH SUBJECTIVE AND OBJECTIVE CODING; EACH ACCIDENT WAS ASSIGNED TO A PARTICULAR ACCIDENT TYPE, OUT OF 17 CATEGORIES, AND CORRELATIONS WERE HIGH BETWEEN THE CODER-ASSIGNED SUBJECTIVE CODE AND THE COMPUTER-ASSIGNED OBJECTIVE CODE.

by RICHARD L. KNOBLAUCH  
BIOTECHNOLOGY, INC., FALLS CHURCH, VA.  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS,  
BICYCLE FACILITIES, DRIVER RESEARCH, AND  
SYSTEM SAFETY," WASHINGTON, 1977 P26-30  
1977; 4REFS  
Availability: IN HS-022 626

HS-022 633

#### BICYCLE TRANSPORTATION FOR DOWNTOWN WORK TRIPS: A CASE STUDY IN DAVIS, CALIFORNIA

THE ROLE OF THE BICYCLE AS A TRANSPORTATION MODE TO WORK IN DAVIS, CALIF., IS CONSIDERED, WITH THE DEVELOPMENT OF ALTERNATIVE, LOGIT-CHOICE MODELS FOR DETERMINING BICYCLE USE. DATA USED CONSIST OF A SAMPLE OF 802 DOWNTOWN WORKERS. AGE, SEX, OCCUPATION, STUDENT STATUS, AND DISTANCE BETWEEN WORK PLACE AND RESIDENCE WERE EXAMINED IN RELATION TO MODAL SELECTION. THE RATE OF BICYCLE USE AS A MODE OF TRANSPORTATION WAS LOWER FOR MANAGERS AND THOSE EMPLOYED IN AREAS SUCH AS TRANSPORTATION, UTILITIES, COMMUNICATIONS, FINANCE, REAL ESTATE, AND INSURANCE THAN FOR WORKERS EMPLOYED IN OTHER AREAS. IN ANALYZING THE CONTRIBUTION OF THESE FACTORS, A METHODOLOGY WAS USED THAT HAD BEEN DEVELOPED IN DISAGGREGATE-BEHAVIORAL, TRAVEL-DEMAND STUDIES, TO DEVELOP ALTERNATIVE MODAL-CHOICE MODELS. SEQUENTIAL BINARY AND MULTINOMIAL LOGIT-CHOICE MODELS WERE TESTED. THE RESULTING MODELS WERE SATISFACTORY FOR EXPLORATORY PURPOSES SINCE MANY OF THE INDEPENDENT VARIABLES WERE USEFUL IN EXPLAINING MODEL CHOICE. THERE IS POTENTIAL FOR INCORPORATING INFORMATION ON BICYCLE USE IN TRANSPORTATION PLANNING MODELS, BUT EXTENSION OF THE MODEL, IN QUANTITATIVE TERMS, TO AREAS NOT SIMILAR TO DAVIS SHOULD AWAIT DATA ON USAGE UNDER DIFFERENT CIRCUMSTANCES.

by DONNA Y. LOTT; TIMOTHY J. TARDIFF; DALE F. LOTT  
BICYCLE RES. ASSOCIATES, DAVIS, CALIF.; UNIV. OF CALIFORNIA, DAVIS  
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BICYCLE FACILITIES, DRIVER RESEARCH, AND  
SYSTEM SAFETY," WASHINGTON, 1977 P30-7  
1977; 14REFS  
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HS-022 634

#### CITIZEN PARTICIPATION IN PLANNING AND DESIGNING BIKEWAYS

BENEFITS FROM CITIZEN PARTICIPATION IN PLANNING COMMUNITY BIKEWAY SYSTEMS INCLUDE MOBILIZATION OF IDLE RESOURCES, USE OF SOURCES OF KNOWLEDGE FROM CITIZENS REPRESENTING VARIOUS PROFESSIONS AND LEVELS OF SOCIETY, AFFIRMATION OF THE DEMOCRATIC PROCESS, IMPROVEMENT IN THE QUALITY OF DECISIONS, AND RECOGNITION OF THE GOALS AND PRIORITIES THAT AFFECT CITIZENS. DISADVANTAGES ARE A POSSIBLE INCREASE IN THE DISPARITIES EXISTING BETWEEN CITIZEN GROUPS AND BETWEEN SUCH GROUPS AND PROFESSIONAL PLANNERS, GREATER COST WITH LESS EFFICIENCY, AN INCREASE IN THE INFLUENCE OF SOME CITIZEN GROUPS, AND INCOMPATIBILITY WITH THE MERIT SYSTEM AND PROFESSIONALISM. COMMUNITY PAR-

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TICIPATION TECHNIQUES INVOLVE ADVISORY COMMITTEES, USE OF SURVEYS AND QUESTIONNAIRES, PRESENTATION BY THE PLANNING AGENCY OF A RANGE OF ALTERNATIVES EARLY IN THE PLANNING PROCESS, COST/BENEFIT ANALYSIS, PROJECT ILLUSTRATIONS, PUBLIC HEARINGS, AND WORKING MEETINGS. SUCH MEETINGS PROVIDE AN ENVIRONMENT FOR PROFESSIONALS AND CITIZENS TO INTERACT. VARIOUS METHODS OF EDUCATION (ROLE-PLAYING, CHALETTE - AN INTENSIVE BRAINSTORMING PROCESS) AND INTERACTION (DIALECTICAL SCANNING) ARE MOST APPLICABLE TO THE COMMUNITY'S EFFORTS.

by WESLEY LUM  
FEDERAL HWY. ADMINISTRATION  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY," WASHINGTON, 1977 P37-43  
1977; 23REFS  
Availability: IN HS-022 626

HS-022 635

#### **EVALUATING THE IMPACT OF WEATHER ON BICYCLE USE**

A METHOD IS PRESENTED FOR EMPIRICALLY EXAMINING THE IMPACT OF DAILY WEATHER CONDITIONS ON THE USE OF THE BICYCLE AS AN URBAN TRANSPORTATION MODE. IN UPPSALA, SWEDEN, IN THE SPRING OF 1971, A HOUSEHOLD TRAVEL SURVEY COLLECTED LONGITUDINAL, DISAGGREGATE TRAVEL DATA ON THE DAILY INTRAURBAN MOVEMENTS OF SOME 300 HOUSEHOLDS OVER A 39-DAY PERIOD. THE DAILY PROPORTION OF BICYCLE TRAVEL FOR DISCRETIONARY PURPOSES AND JOURNEY TO WORK IS COMPARED TO DAILY WEATHER DATA. CORRELATION AND REGRESSION ANALYSES WERE USED TO ASSESS THE IMPACT OF WEATHER ON BICYCLE USE. INDICATIONS ARE THAT TEMPERATURE AND CLOUD COVERAGE DO AFFECT THE PROPORTION OF DAILY TRAVEL MADE BY BICYCLE AND THAT THE WEATHER VARIABLES HAVE A DIFFERENT IMPACT ON EACH OF THE TWO TYPES OF BICYCLE TRAVEL. THE STUDY ALSO EXAMINES THE ALTERNATIVE MODES USED ON DAYS WHEN LITTLE TRAVEL IS DONE BY BICYCLE. A LARGER PROPORTION OF TRAVEL TO WORK IS DONE BY BICYCLE THAN OF TRAVEL FOR DISCRETIONARY PURPOSES REGARDLESS OF WEATHER CONDITIONS. WHEN THE TEMPERATURE IS BELOW FREEZING, BETWEEN 20% AND 25% OF ALL TRIPS TO WORK ARE MADE BY BICYCLE.

by SUSAN HANSON; PERRY HANSON  
STATE UNIV. OF NEW YORK, BUFFALO  
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1977; 8REFS  
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Availability: IN HS-022 626

HS-022 636

#### **DEVELOPMENT OF A BICYCLE ACCIDENT RATE IN ARIZONA**

THE RELATIONSHIP BETWEEN THE NUMBER OF BICYCLE ACCIDENTS THAT OCCUR IN A DEFINED AREA FOR A SPECIFIC TIME PERIOD AND THE BICYCLE USAGE FOR THAT TIME PERIOD IS CONSIDERED. CALCULATING THIS RATE FOR THE SAME AREA FOR DIFFERENT TIME PERIODS PRODUCED A STANDARD OR MEASURE FROM WHICH TRENDS CAN BE DEVELOPED; THESE RATES CAN ALSO BE USED TO COMPARE TRENDS IN OTHER AREAS. THE UNITS FOR THE BICYCLE ACCIDENT RATE (BAR) USED IN THE STUDY ARE THE NUMBER OF ACCIDENTS THAT OCCUR PER 1,000,000 BICYCLE TRIPS. ANALYSIS AND APPLICATION OF BAR'S IS PRESENTED, AND THE BAR IS CONCLUDED TO BE A BETTER MEASURE FOR DEVELOPING TRENDS THAN THE PRESENT USE OF PERCENTAGES. THE BAR IS REPRESENTATIVE OF THE RELATION BETWEEN THE NUMBER OF BICYCLE ACCIDENTS AND BICYCLE USAGE; THE BICYCLE ACCIDENT PROBLEM IS INCREASING IN URBAN AREAS AND DECREASING IN RURAL AREAS; METROPOLITAN URBAN AREAS COLLECTIVELY HAVE MORE OF A BICYCLE ACCIDENT PROBLEM THAN THE SEPARATE URBAN AREAS; IF CURRENT TRENDS CONTINUE AND CONDITIONS REMAIN CONSTANT, BICYCLE ACCIDENTS WILL TRIPLE IN THE STATE OF ARIZONA (AREA OF STUDY) AND QUADRUPLE IN TEMPE BY 1990. BETTER BICYCLE SAFETY PROGRAMS ARE NEEDED, WITH FURTHER STUDY AND RESEARCH. MANDATORY REGISTRATION OF BICYCLES IS SUGGESTED AS A HELP IN DETERMINING USAGE.

by RICHARD G. PERREAULT; JUDSON S. MATTHIAS;  
MARY R. ANDERSON  
ARIZONA STATE UNIV.  
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1977; 3REFS  
Availability: IN HS-022 626

HS-022 637

#### **EFFECT OF BICYCLE LANE USAGE ON VEHICLES IN THE ADJACENT LANE**

AN APPROACH IS PRESENTED FOR INVESTIGATING THE EFFECT OF BICYCLES IN A BICYCLE LANE ON THE CHARACTERISTICS OF THE TRAFFIC STREAM IN THE ADJACENT LANE. PREVIOUS WORK RELATED TO THIS SUBJECT IS REVIEWED, AND A POSSIBLE MODEL TO ANALYZE THE IMPACT OF BICYCLES ON LEVEL OF SERVICE IS PROPOSED. THE MODEL USES THE DIFFERENCE IN VEHICLE SPEED WITH AND WITHOUT THE PRESENCE OF BICYCLES. THE APPLICATION OF THIS MODEL TO CAPACITY ANALYSIS IS DISCUSSED, AND A PROGRAM OF EXPANSION AND TESTING RECOMMENDED. THE METHOD OF DATA COLLECTION EMPLOYED IS PRESENTED. A LIMITED DATA SET FROM A FIELD STUDY IS ANALYZED, AND THE RESULTS TESTED FOR STATISTICAL SIGNIFICANCE. RESULTS OF THE ANALYSIS INDICATE THAT THERE IS A MEASURABLE REDUCTION IN

IDAHO TRANSPORTATION DEPT., BOISE; OREGON  
STATE UNIV., DEPT. OF CIVIL ENGINEERING  
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SYSTEM SAFETY," WASHINGTON, 1977 P51-6  
1977; 6REFS  
Availability: IN HS-022 626

HS-022 638

### **AN EXPERIMENTAL STUDY OF THE DEFENSIVE DRIVING COURSE**

AN EXPERIMENT WITH A DEFENSIVE DRIVING COURSE (DDC) SUPPORTED THE THEORY OF THE POTENTIAL BENEFITS TO BE GAINED FROM THE APPLICATION OF MARKETING RESEARCH AND EXPERIMENTAL PROCEDURES TO A SOCIAL PRODUCT SUCH AS THE DDC. THE OVERALL SUCCESS OF A SOCIAL PRODUCT RESULTS FROM A COMBINATION OF ADOPTION RATE AND EFFECTIVENESS AND PRODUCT DESIGN IMPROVEMENT INVOLVES THE GENERATION OF AN ATTRACTIVE ALTERNATE PRODUCT DESIGN, WHICH IS EVALUATED AND COMPARED WITH THE CONVENTIONAL DESIGN ON THE BASIS OF APPROPRIATE ADOPTION RATE AND EFFECTIVENESS MEASURES. GROUP INTERVIEWS AND PRELIMINARY MARKETING RESEARCH THAT INVOLVED ACTUAL AND POTENTIAL CONSUMERS OF A DDC WERE USED TO IDENTIFY A NUMBER OF SALIENT COURSE CHARACTERISTICS. THE SCOPE OF THE STUDY WAS LIMITED BY CONFINING THE INVESTIGATION TO A SINGLE IMPORTANT COURSE DIMENSION-PROGRAM CONTEXT. BASED ON FURTHER MARKETING RESEARCH COMBINED WITH THE JUDGMENT OF EXPERTS IN THE DRIVER EDUCATION FIELD, AN ALTERNATE DDC WAS FORMULATED THAT INCLUDED THREE NEW CONTENT ITEMS AND FUEL ECONOMY TRAINING. SUBSEQUENT EXPERIMENTAL ADMINISTRATION AND TESTING OF THE ALTERNATE AND CONVENTIONAL PROGRAMS REVEALED THAT THE ALTERNATE PROGRAM WAS RESPONSIBLE FOR MALE DRIVERS EXHIBITING A SIGNIFICANT IMPROVEMENT ON TWO OF THE THREE INTERMEDIATE MEASURES OF EFFECTIVENESS, I.E. FUEL CONSUMPTION AND BEHIND-THE-WHEEL TESTS, AND FOR FEMALE DRIVERS EXHIBITING AN IMPROVEMENT IN THE FUEL CONSUMPTION TEST. FOLLOWING THE LABORATORY EXPERIMENT TO MEASURE PROGRAM EFFECTIVENESS, THE PROGRAMS WERE SUBJECTED TO A FIELD ADOPTION EXPERIMENT IN A SUBURBAN COMMUNITY SETTING. COMPARISON OF THE RESULTING COURSE REGISTRATIONS REVEALED A SIGNIFICANTLY HIGHER RATE OF ADOPTION FOR THE ALTERNATE PROGRAM. IT IS RECOMMENDED THAT THE NATIONAL SAFETY COUNCIL INVESTIGATE THE ADOPTION OF A STRATEGY OF DIFFERENTIATED MARKETING IN WHICH THE HETEROGENEITY OF THE MARKET WOULD BE RECOGNIZED AND MET WITH MORE THAN A SINGLE DRIVER IMPROVEMENT PROGRAM; THE CONVENTIONAL DDC PROGRAM SHOULD BE SUPPLEMENTED WITH ONE OR MORE COURSES NOT ASSOCIATED WITH A FORM OF PUNISHMENT FOR TRAFFIC CITA-

INDIANA UNIV. OF PENNSYLVANIA, SCHOOL OF  
BUSINESS  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS,  
BICYCLE FACILITIES, DRIVER RESEARCH, AND  
SYSTEM SAFETY," WASHINGTON, 1977 P56-62  
1977; 5REFS  
Availability: HS-022 626

HS-022 639

### **MEASURING THE OUTCOMES OF DRIVER TRAINING: UNIVERSITY OF SOUTHERN CALIFORNIA DRIVER PERFORMANCE TEST**

THE UNIV. OF SOUTHERN CALIFORNIA (USC) DRIVER PERFORMANCE TEST WAS DEvised TO BE RELIABLE, VALID, AND FEASIBLE FOR ROUTINE ADMINISTRATION IN HIGH SCHOOLS. IT REQUIRES 30 MINUTES AND IS SCORED BY A TRAINED CODER, THE SCORING SIMPLIFIED TO PERMIT THE CODER TO FOCUS ON OBSERVING AND JUDGING DRIVER BEHAVIOR. STANDARDS FOR PERFORMANCE ARE LEARNED BY THE CODERS DURING A 40 HOUR TRAINING PROGRAM. THE TEST REQUIRES DRIVER INTERACTION WITH MODERATELY HEAVY TRAFFIC AND IS INTENDED TO TEST THE LIMITS OF DRIVER PERFORMANCE. INTERCODER AGREEMENT WAS ABOUT 80%, EVEN THOUGH THERE WERE DIFFERENT SEATING POSITIONS. SOME CHANGES IN SCORING ASSIGNMENTS AND TRAINING ARE EXPECTED TO IMPROVE THE RELIABILITY OF THE TEST. THIS PILOT STUDY WAS CARRIED OUT WITH 197 STUDENTS AT THE END OF THEIR DRIVING TRAINING COURSE. A NUMBER OF PART SCORES AND SUBTOTALS WERE USED SO THAT FAULTS COULD BE DIAGNOSED. THERE WAS A WIDE RANGE IN DRIVER PROFICIENCY, BUT IN GENERAL THESE NOVICE DRIVERS DID POORLY IN VISUAL SCANNING, AT INTERSECTIONS AND IN CHECKING MIRRORS; FREQUENTLY CHOSE AN UNSAFE LOCATION FOR THREE-POINT TURNABOUTS, AND DID NOT LOOK BACK WHILE BACKING UP IN A TURNABOUT SITUATION. THE HYPOTHESIS THAT INADEQUATE SCANNING IS CAUSED BY LACK OF SURE AND AUTOMATIC RESPONSES TO AUTOMOBILE CONTROL COULD BE TESTED IMMEDIATELY BY TRAINING STUDENT DRIVERS TO SCAN USING A CONTROL GROUP DESIGN.

by MARGARET HUBBARD JONES  
UNIVERSITY OF SOUTHERN CALIFORNIA, TRAFFIC  
SAFETY CENTER  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS,  
BICYCLE FACILITIES, DRIVER RESEARCH, AND  
SYSTEM SAFETY," WASHINGTON, 1977 P63-7  
1977; 9REFS  
RESEARCH PERFORMED UNDER CONTRACT TO  
NATIONAL HWY. TRAFFIC SAFETY  
ADMINISTRATION.  
Availability: IN HS-022 626



A STUDY WAS MADE TO DETERMINE THE FEASIBILITY OF TRAINING DRIVERS TO ACQUIRE THE SKILLS NEEDED TO AVOID IMMINENT, CRITICAL-CONFLICT, MOTOR-VEHICLE ACCIDENTS, AND TO DEVELOP THE METHODS AND MATERIALS NECESSARY TO ACCOMPLISH SUCH TRAINING. BASIC DATA WERE DERIVED FROM IN-DEPTH ACCIDENT INVESTIGATIONS AND TASK ANALYSES OF DRIVER BEHAVIOR. A SPECIFICATION WAS PREPARED FOR CURRICULUM DEVELOPMENT AND PERFORMANCE MEASUREMENT. A PROTOTYPE BIMODAL SIMULATOR WAS DEVELOPED, CONSISTING OF A PLAN-VIEW GENERATOR FOR SIMULATING TRAFFIC CONFLICTS, A DRIVER-CONTROL STATION, AN INSTRUCTOR-CONTROL STATION, AND A VIDEO SYSTEM. THIS WAS USED AS A TRAINING TOOL FOR ACQUISITION OF KEY PERCEPTUAL AND DECISIONMAKING SKILLS, AND A CONCEPT WAS DEFINED FOR BEHIND-THE-WHEEL TRAINING ON AN ADVANCED DRIVING RANGE THAT INCLUDED SURROGATE VEHICLES TO CREATE CRITICAL TRAFFIC CONFLICTS. RESULTS OF THE STUDY INDICATE THAT SUCH TRAINING IS THEORETICALLY FEASIBLE AND, IF IMPLEMENTED ON A LARGE SCALE, COULD RESULT IN A SUBSTANTIAL REDUCTION OF MULTIVEHICLE ACCIDENTS.

by G. RICHARD HATTERICK; RICHARD F. PAIN  
GRH CONSULTING, FAIRFAX, VA.; BIOTECHNOLOGY,  
INC., FALLS CHURCH, VA.  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS,  
BICYCLE FACILITIES, DRIVER RESEARCH, AND  
SYSTEM SAFETY," WASHINGTON, 1977 P68-77  
1977; 12REFS  
SUPPORTED BY NATIONAL HWY. TRAFFIC SAFETY  
ADMINISTRATION.  
Availability: IN HS-022 626

HS-022 641

#### **SYSTEM-SAFETY TECHNIQUES USEFUL FOR TRANSPORTATION SAFETY**

A REVIEW IS MADE OF EXISTING SYSTEM-SAFETY TECHNIQUES IN TERMS OF THEIR APPLICABILITY TO THE CURRENT TRANSPORTATION STRUCTURE, STATUS, AND AVAILABLE DATA; THEIR EASE OF COMPREHENSION; AND THEIR USEFULNESS IN REDUCING ACCIDENTS AND FATALITIES. THE TWO TECHNIQUES OF FAILURE MODE EFFECTS AND CRITICALITY ANALYSIS AND FAULT-TREE ANALYSIS ARE REVIEWED, EXPLAINED, AND MODIFIED FOR USE IN TRANSPORTATION SAFETY STUDIES. WHEN APPLIED AT EACH LEVEL OR ACTIVITY CYCLE OF A TRANSPORTATION SYSTEM, THESE TWO TECHNIQUES PROVIDE SAFETY SPECIALISTS WITH TOOLS THAT LEAD TO CONCERN FOR SAFETY AT EVERY STAGE OF A PROJECT FROM CONCEPTION THROUGH FACILITY OPERATION. THE COHESIVE APPROACH SUGGESTED BY THE CONCEPT OF SYSTEM SAFETY IS WELL SUITED TO THE NEEDS OF TRANSPORTATION SAFETY; ORIENTED TOWARD ACTION RATHER THAN REACTION, IT DOES NOT ELIMINATE RISKS BUT RATHER MAKES SURE THEY ARE CONTROLLED AND MADE KNOWN TO MANAGEMENT.

SET AND REFINED AS THE WORK PROGRESSES.  
by MICHAEL HORODNICEANU; EDMUND J. CANTILLI;  
MARTIN L. SHOOMAN; LOUIS J. PIGNATARO  
POLYTECHNIC INST. OF NEW YORK, DEPT. OF  
TRANSPORTATION PLANNING AND ENGINEERING  
Publ: HS-022 626 (TRR-629), "PEDESTRIAN CONTROLS,  
BICYCLE FACILITIES, DRIVER RESEARCH, AND  
SYSTEM SAFETY," WASHINGTON, 1977 P77-84  
1977; 9REFS  
Availability: IN HS-022 626

HS-022 642

#### **WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS FOR STATE, REGIONAL, AND LOCAL GOVERNMENT OFFICIALS. FINAL REPORT**

A DESCRIPTION OF AND RECOMMENDATIONS RESULTING FROM FOUR WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS ON THE STATE, REGIONAL, AND LOCAL LEVELS WHICH WERE SPONSORED BY THE DEPT. OF TRANSPORTATION (DOT) IN THE SPRING OF 1977 ARE PRESENTED. THE PURPOSE OF THE WORKSHOPS WAS TO PROVIDE ASSISTANCE TO DOT IN IDENTIFYING THE REQUIREMENTS FOR RESEARCH AND DEVELOPMENT IN THE AREA OF TRANSPORTATION SYSTEM AND FACILITY IMPACTS ON AIR POLLUTION. ONE HUNDRED AND SIXTY-SIX PERSONS ATTENDED THE WORKSHOPS, REPRESENTING LEADERS IN THE TRANSPORTATION AND ENVIRONMENTAL PROTECTION FIELDS FROM LOCAL, REGIONAL, STATE, AND FEDERAL GOVERNMENTS. THE TEN MOST IMPORTANT TRANSPORTATION-AIR QUALITY ISSUES REQUIRING RESEARCH AND DEVELOPMENT EFFORTS ARE DEFINED AND INCLUDE THE FOLLOWING, IN ORDER OF IMPORTANCE: AIR QUALITY MODELING (AQM), INTEGRATION AND COORDINATION OF INTERACTING FEDERAL PROGRAMS (ICP), MOBILE EMISSION FACTORS (MEF), EDUCATION OF THE PUBLIC (EOP), INTERAGENCY COOPERATION (IAC), TRANSPORTATION CONTROL ASSESSMENT (TCA), TRANSPORTATION MODELING (TRM), STUDY PLANNING AND ANALYSIS (SPA), AEROMETRIC MONITORING (AMM), AND INTEGRATED AND COMPREHENSIVE ANALYSIS (ICA). SIXTEEN SPECIFIC RESEARCH RECOMMENDATIONS ADDRESSING THESE PRIORITY ISSUES ARE DESCRIBED AND ARE AS FOLLOWS, BY TYPE AND TITLE: SYSTEMS ANALYSIS, PROJECT ANALYSIS, AND POLICY ALTERNATIVES: PROGRAM-RELATED RESEARCH (GENERAL AIR QUALITY MODELING, IDENTIFICATION AND COORDINATION OF ISSUES); SYSTEMS ANALYSIS: TASK-RELATED RESEARCH (IMPROVEMENT OF SYSTEM AIR QUALITY MODELS; CALIBRATION AND VALIDATION OF MODELS; IMPROVE CONSISTENCY ASSESSMENT PROCESS, PUBLIC INFORMATION/EDUCATION; EVALUATION OF TRANSPORTATION CONTROL STRATEGIES; IMPROVEMENTS IN NECESSARY TRANSPORTATION MODELING, METHODOLOGY, AND COORDINATION WITH AIR QUALITY MODELING); PROJECT ANALYSIS: TASK-RELATED RESEARCH (IMPROVE MICROSCALE POLLUTANT DISPERSION MODELS, IMPROVE INFORMATION DISSEMINATION THROUGH INTERAGENCY



COOPERATION/COORDINATION, IMPROVE SPECIFICATIONS FOR STUDY PLANNING AND ANALYSIS, IMPROVE METHODS AND PROCEDURES FOR AEROMETRIC MONITORING, IMPROVE MOBILE-SOURCE EMISSION FACTORS); AND POLICY ALTERNATIVES: TASK-RELATED RESEARCH (DEVELOP NEW METHODOLOGIES FOR INTEGRATED AND COMPREHENSIVE ANALYSIS, INTEGRATION AND COORDINATION OF GOALS AND POLICIES, PUBLIC EDUCATION ON TRANSPORTATION POLICY).

TRANSPORTATION SYSTEMS CENTER, KENDALL SQUARE, CAMBRIDGE, MASS. 02142  
Rept. No. DOT-TSC-OST-77-69; 1977; 111P 3REFS  
REPT. FOR APR-JUL 1977.  
Availability: NTIS

HS-022 643

# **ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION--A FEASIBILITY STUDY. VOL. 1--EXECUTIVE SUMMARY**

A STUDY TO ASSESS THE TECHNICAL AND ECONOMIC FEASIBILITY OF ALTERNATIVE FUELS (FROM DOMESTIC ENERGY SOURCES) FOR FUTURE AUTOMOTIVE TRANSPORTATION NEEDS IN THE U.S. IS SUMMARIZED. THE STUDY CONSIDERED THREE TIME FRAMES, NEAR TERM (1975-1985), MID TERM (1985-2000), AND FAR TERM (BEYOND 2000). THE FOLLOWING 16 POTENTIAL AUTOMOTIVE FUELS WERE STUDIED: ACETYLENE, AMMONIA, CARBON MONOXIDE, COAL, DISTILLATE OILS, ETHANOL, GASOLINES (C5-C10), HEAVY OILS, HYDRAZINE, HYDROGEN, SLPG (SUBSTITUTE LIQUIFIED PETROLEUM GAS), METHANOL, METHYLAMINE, SNG (SUBSTITUTE NATURAL GAS), NAPHTHAS, AND VEGETABLE OILS. THE FOLLOWING 12 POTENTIAL DOMESTIC SOURCES OF ENERGY WERE CONSIDERED: COAL, SHALE OIL, TAR SANDS, URANIUM AND THORIUM, NUCLEAR FUSION, SOLAR RADIATION, SOLID WASTES (GARBAGE), ANIMAL WASTES, WIND POWER, TIDAL POWER, HYDROPOWER, AND GEOTHERMAL HEAT. IN ADDITION, FOUR AUXILIARY MATERIAL SOURCES WERE STUDIED (AIR (OXYGEN, CARBON DIOXIDE, NITROGEN), ROCK (LIMESTONE), WATER, LAND). IT WAS CONCLUDED THAT IT IS FEASIBLE TO PRODUCE ALTERNATIVE AUTOMOTIVE FUELS FROM DOMESTIC RESOURCES WITHIN THE FORESEEABLE FUTURE AND IN QUANTITIES SUFFICIENT TO ALLEVIATE PETROLEUM IMPORTS. THE ADEQUATE ENERGY RESOURCES ARE COAL, OIL SHALE, AND FISSIONABLE NUCLEAR FUELS. THE PREFERRED AUTOMOTIVE FUELS ARE GASOLINE AND DISTILLATE HYDROCARBONS, METHANOL, AND HYDROGEN. IF IT WERE NOT FOR HIGHER-PRIORITY USES, SNG AND SLPG WOULD BE FAVORED FUELS FOR AUTOMOTIVE USE. THE PRODUCTION OF FISSIONABLE FUELS (URANIUM AND PLUTONIUM) FROM FERTILE MATERIALS (THORIUM OR DEPLETED URANIUM) IS A PRACTICAL REQUIREMENT FOR NUCLEAR ENERGY TO BE ASSURED AS A MAJOR ENERGY SUPPLY BEYOND 1985. AS A POTENTIAL SOURCE OF ENERGY IN THE FAR TERM AND BEYOND AND ALMOST WITHOUT RAW MATERIAL LIMITS, FUSION REACTORS PROMISE AN EVENTUAL SOLUTION OF THE CONTINUING ENERGY CRISIS. TO

BE PRACTICAL, SOLAR PLANTATIONS NEED HIGHER ENERGY EFFICIENCIES AND MUST NOT REDUCE NECESSARY DOMESTIC FOOD-CROP CAPABILITIES. A NONFOSSIL AND NONELECTRIC PROCESS FOR PRODUCING A CHEMICAL FUEL FROM A RENEWABLE MATERIAL RESOURCE IS HIGHLY DESIRABLE. THERE IS PRESENTLY NO SATISFACTORY METHOD TO TANK SUFFICIENT HYDROGEN ON-BOARD A VEHICLE.

by J. PANGBORN; J. GILLIS  
INSTITUTE OF GAS TECHNOLOGY, CHICAGO, ILL. 60616  
EPA-68-01-2111  
Rept. No. EPA-460/3-74-012-A; 1974; 34P 2REFS  
VOL. 2 (TECHNICAL SECTION) IS HS-022 644.  
Availability: ENVIRONMENTAL PROTECTION AGENCY, POLLUTION TECHNICAL INFORMATION CENTER, RESEARCH TRIANGLE PARK, N.C. 27711

HS-022 644

# **ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION--A FEASIBILITY STUDY. VOL. 2--TECHNICAL SECTION**

AN ASSESSMENT WAS MADE OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF ALTERNATIVE FUELS (FROM DOMESTIC ENERGY SOURCES) FOR FUTURE AUTOMOTIVE TRANSPORTATION NEEDS IN THE U.S. THE STUDY CONCERNED THREE TIME FRAMES: NEAR TERM (1975-1985), MID TERM (1985-2000), AND FAR TERM (BEYOND 2000). THE FOLLOWING 16 POTENTIAL AUTOMOTIVE FUELS WERE STUDIED: ACETYLENE, AMMONIA, CARBON MONOXIDE, COAL, DISTILLATE OILS, ETHANOL, GASOLINES (C5-C10), HEAVY OILS, HYDRAZINE, HYDROGEN, SLPG (SUBSTITUTE LIQUEFIED PETROLEUM GAS), METHANOL, METHYLAMINE, SNG (SUBSTITUTE NATURAL GAS), NAPHTHAS, AND VEGETABLE OILS. THE FOLLOWING 12 POTENTIAL DOMESTIC SOURCES OF ENERGY WERE CONSIDERED: COAL, SHALE OIL, TAR SANDS, URANIUM AND THORIUM, NUCLEAR FUSION, SOLAR RADIATION, SOLID WASTES (GARBAGE), ANIMAL WASTES, WIND POWER, TIDAL POWER, HYDROPOWER, AND GEOTHERMAL HEAT. IN ADDITION, FOUR AUXILIARY MATERIAL SOURCES WERE STUDIED (AIR (OXYGEN, CARBON DIOXIDE, NITROGEN), ROCK (LIMESTONE), WATER, LAND). CANDIDATE ALTERNATIVE FUELS WERE EVALUATED IN TERMS OF THE FOLLOWING CRITERIA: ADEQUACY OF ENERGY AND MATERIAL AVAILABILITY AND COMPETING DEMANDS FOR FUEL; THE EXISTENCE OF KNOWN OR DEVELOPING FUEL SYNTHESIS TECHNOLOGIES; SAFETY (TOXICITY) AND HANDLING PROPERTIES OF FUELS; RELATIVE COMPATIBILITY WITH CONTEMPORARY FUEL TRANSPORT FACILITIES AND UTILIZATION EQUIPMENT (TANKS AND ENGINES); SEVERITY OF ENVIRONMENTAL IMPACTS AND RESOURCE DEPLETION; AND FUEL SYSTEM ECONOMICS (RESOURCE EXTRACTION, FUEL SYNTHESIS AND DELIVERY, AUTOMOTIVE UTILIZATION). TWO ENERGY AND SUPPLY PROJECTIONS (MODELS) WERE DEVELOPED IN ORDER TO PRESENT AN ILLUSTRATION OF THE METHODOLOGY OF FUEL SELECTION, AND TO PROVIDE AN OPTIMISTIC POSSIBILITY OF DOMESTIC ENERGY SELF-SUFFICIENCY AS WELL AS A PES-

August 31, 1978

HS-022 647

SIMISTIC POSSIBILITY OF CONTINUED DEPENDENCY ON ENERGY IMPORTS. THE PROJECTIONS ARE NOT INTENDED AS MODELS OF ENERGY ALLOCATION; RATHER, THEY ARE INTENDED TO SHOW QUANTITATIVELY THE DEFICITS AND EXCESSES THAT COULD EXIST IN FUTURE TIME FRAMES.

by J. PANGBORN; J. GILLIS  
INSTITUTE OF GAS TECHNOLOGY, CHICAGO, ILL.  
60616  
EPA-68-01-2111  
Rept. No. EPA-460/3-74-012-B; 1974; 279P REFS  
VOL. 1 (EXECUTIVE SUMMARY) IS HS-022 643.  
Availability: ENVIRONMENTAL PROTECTION AGENCY,  
POLLUTION TECHNICAL INFORMATION CENTER,  
RESEARCH TRIANGLE PARK, N.C. 27711

HS-022 645

### **ELECTRIC VEHICLE SYSTEMS FY 1978. ENVIRONMENTAL DEVELOPMENT PLAN**

THIS ENVIRONMENTAL DEVEL. PLAN (EDP) IDENTIFIES THE ENVIRONMENTAL, ECOLOGICAL, SOCIAL/ECONOMIC, HEALTH, SAFETY, AND NATURAL RESOURCE ISSUES ASSOCIATED WITH THE ENERGY RES. AND DEVEL. ADMINISTRATION'S (ERDA) RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF ELECTRIC VEHICLES USED FOR PERSONAL HIGHWAY TRANSPORTATION AND PRESENTS AN "ENVIRONMENTAL" RESEARCH AND DEVELOPMENT STRATEGY FOR RESOLVING THE ISSUES. THE EDP PROVIDES A FRAMEWORK FOR THE FOLLOWING: INCORPORATING ENVIRONMENTAL CONSIDERATIONS INTO AGENCY PLANNING PROCESSES AT THE EARLIEST STAGES; RESOLVING ENVIRONMENTAL ISSUES CONCURRENTLY WITH ENERGY TECHNOLOGY DEVELOPMENT; AND ASSURING THAT ADVERSE ENVIRONMENTAL EFFECTS ARE MITIGATED THROUGH SOUND TECHNOLOGICAL DESIGN AND ARE AT THE SAME LEVEL OF IMPORTANCE AS TECHNOLOGICAL, ECONOMIC, AND INSTITUTIONAL ISSUES IN DECISIONMAKING. THE ENVIRONMENTAL ISSUES ADDRESSED CONSIDER ONLY THE ELECTRIC VEHICLE PRODUCTION, OPERATION, AND DISPOSAL SUBSYSTEMS AND EXCLUDE ISSUES ASSOCIATED WITH THE PRODUCTION OF ELECTRICAL ENERGY USED TO ENERGIZE THE ELECTRIC VEHICLE BATTERIES. FOURTEEN PRIORITY ISSUES FOR ELECTRIC VEHICLE TECHNOLOGY WERE IDENTIFIED AND ARE CLASSIFIED ACCORDING TO THE FOLLOWING CATEGORIES AND THE ELECTRIC VEHICLE COMPONENTS/UNITS TO WHICH THEY PERTAIN: HEALTH (LEAD-ACID BATTERIES; BATTERIES, GENERAL; BODY/CHASSIS); SAFETY (BATTERIES, GENERAL; ZINC-CHLORINE BATTERIES; SODIUM-SULFUR BATTERIES; CHARGER; ON-BOARD CHARGER; BODY/CHASSIS; 2-PASSENGER VEHICLE, 4-PASSENGER VEHICLE, DELIVERY VAN); AND SOCIOECONOMIC, INSTITUTIONAL (ELECTRIC VEHICLE MOTOR) AND SOCIOECONOMIC, SOCIAL (2-PASSENGER VEHICLE, 4-PASSENGER VEHICLE, DELIVERY VAN; ELECTRIC VEHICLE SYSTEM).

ENERGY RES. AND DEVEL. ADMINISTRATION,  
WASHINGTON, D.C. 20545  
Rept. No. EDP/C-01-(77); 1977; 118P 15REFS  
Availability: NTIS

HS-022 646

### **FEASIBILITY TEST ON COMPOUNDING THE INTERNAL COMBUSTION ENGINE FOR AUTOMOTIVE VEHICLES, TASK 2. FINAL REPORT**

AN EARLY FEASIBILITY DEMONSTRATION TEST OF COMPOUNDING THE DIESEL TRUCK ENGINE WITH AN ORGANIC RANKINE-CYCLE SYSTEM (ORCS) IS REPORTED. THIS FEASIBILITY STUDY WAS INITIATED BASED ON A CONCEPTUAL DESIGN STUDY OF COMPOUNDING THE INTERNAL COMBUSTION ENGINE (TASK 1 INTERIM REPT., WHICH IS APPENDED) WHICH SHOWED A 15% FUEL ECONOMY IMPROVEMENT POTENTIAL OVER THE DUTY CYCLE. THE DEMONSTRATION SYSTEM USED A MACK ENDT 676 DIESEL ENGINE WITH EXISTING BUT NONOPTIMUM ORCS HARDWARE MADE AVAILABLE FROM AN EARLIER AUTOMOTIVE RANKINE-CYCLE PROGRAM. RESULTS OF BOTH STEADY-STATE AND TRANSIENT TESTS OVER THE OPERATING RANGE OF THE DIESEL ENGINE ARE PRESENTED. BY UTILIZING WASTED ENERGY ASSOCIATED WITH THE EXHAUST GASES, THE ORGANIC RANKINE BOTTOMING CYCLE PROVIDES A VIABLE SOLUTION FOR FUEL ECONOMY IMPROVEMENT IN LONG-HAUL DIESEL TRUCKS. THE DEMONSTRATION TESTS PROVED THE FEASIBILITY OF THE DIESEL-ORCS COMPOUND ENGINE AND HAVE SHOWN THE POTENTIAL OF THE PROTOTYPE SYSTEM. THE EFFICIENCY OF THE DIESEL TRUCK ENGINE WAS INCREASED WITH AN ORCS TO RECOVER WASTE HEAT. STEADY-STATE TESTS YIELDED BETTER PERFORMANCE RESULTS THAN THOSE INITIALLY PREDICTED. THE TRANSIENT RESPONSE CHARACTERISTICS OF THE DEMONSTRATION HARDWARE INDICATE A SIMPLE AND MANAGEABLE PROTOTYPE CONTROL SYSTEM.

THERMO ELECTRON CORP., 101 FIRST AVE.,  
WALTHAM, MASS. 02154  
ERDA-E(11-1)-2690  
Rept. No. TE4193-76-75; C00-2690-1; 1974?; 241P 5REFS  
Availability: NTIS PAPER COPY \$8.00 DOMESTIC, \$10.50  
FOREIGN; MICROFICHE \$3.00 DOMESTIC, \$4.50  
FOREIGN

HS-022 647

### **AN ASSESSMENT OF THE TECHNOLOGY OF RANKINE ENGINES FOR AUTOMOBILES**

A CRITICAL REVIEW OF THE WORK ACCOMPLISHED DURING THE PERIOD 1970-1976 TO DEVELOP THE RANKINE-POWERED AUTOMOBILE, WITH EMPHASIS ON THE FEDERAL GOVERNMENT'S DEVELOPMENT PROGRAM, IS PRESENTED. THE FIRST SECTION OF THE REPORT OUTLINES THE STATE OF THE ART IN 1970 PRIOR TO THE GOVERNMENT DEVELOPMENT PROGRAM. THE NEXT SECTION, WHICH FORMS THE MAJOR PORTION OF THE TEXT, DISCUSSES THE WORK ACCOMPLISHED ON THE AUTOMOTIVE RANKINE ENGINE WHICH WAS SPONSORED BY THE ALTERNATIVE AUTOMOTIVE POWER SYSTEMS (AAPS) PROG. OF THE ENVIRONMENTAL PROTECTION AGENCY (EPA) AND THE ENERGY RES. AND DEVEL. ADMINISTRATION (ERDA). A THIRD SECTION OUTLINES THE WORK DONE DURING THIS SAME PERIOD (1970-1976) BY OTHER GOVERNMENT AGENCIES AND

HS-022 648

HSL 78-08

BY PRIVATE DEVELOPERS. FINALLY, THE STATE OF THE ART AS IT EXISTS IN 1977 IS PRESENTED. THE MAJOR CONCLUSIONS ARE THAT THE RANKINE ENGINE CAN PROVIDE VERY LOW EMISSIONS, THAT THE FUEL ECONOMY IS NOT COMPETITIVE WITH SPARK-IGNITION OR PROJECTED ALTERNATIVES AT THIS TIME, AND THAT THERE IS SOME EVIDENCE THAT A VARIETY OF FUELS COULD BE EASILY UTILIZED IN RANKINE ENGINES.

by STEPHEN LUCHTER; ROY A. RENNER  
ENERGY RES. AND DEVEL. ADMINISTRATION, DIV.  
OF TRANSPORTATION ENERGY CONSERVATION,  
WASHINGTON, D.C.  
Rept. No. ERDA-77-54; UC-96; 1977; 96P 72REFS  
Availability: GPO \$2.30, STOCK NO. 060-000-00055-7

HS-022 648

#### **FACTOR STRUCTURE OF THE MICHIGAN ALCOHOLISM SCREENING TEST**

A FACTOR ANALYSIS WAS PERFORMED ON THE ITEM SCORES OF 1000 ADULT MOTORISTS ARRESTED FOR DRIVING WHILE INTOXICATED (DWI) WHO COMPLETED THE MICHIGAN ALCOHOLISM SCREENING TEST (MAST). MAST IS A BRIEF QUESTIONNAIRE (24 ITEMS) DEVELOPED TO ASSESS THE PRESENCE AND EXTENT OF EXCESSIVE DRINKING BY THE RESPONDENT. TEST ITEMS ANSWERED IN THE KEYED DIRECTION ARE DIFFERENTIALLY WEIGHTED TO REFLECT THEIR CONTRIBUTION IN ASSESSING ALCOHOLISM. EXAMINEES SCORING FIVE OR MORE POINTS ARE REGARDED AS ALCOHOLICS, WHILE THOSE SCORING FOUR POINTS ARE VIEWED AS MANIFESTING BORDERLINE ALCOHOLIC SYMPTOMATOLOGY AND THOSE SCORING THREE POINTS OR LESS ARE SEEN AS RELATIVELY WELL ADJUSTED DRINKERS. ITEM SCORES ON THE MAST ARE SUMMED TO YIELD A SINGLE, OVERALL SCORE THAT REFLECTS THE SEVERITY OF ALCOHOL INVOLVEMENT. TEST RESPONSES OF SUBGROUPS OF ALCOHOLICS AND NONALCOHOLICS WERE FACTOR ANALYZED IN ORDER TO DELINEATE THE CHARACTERISTIC DIMENSIONS OF ALCOHOL-RELATED BEHAVIOR. A MULTIDIMENSIONAL STRUCTURE OF THE MAST IN EACH OF THE TWO SUBGROUPS INDICATED THAT DWI OFFENDERS GENERALLY, AND THOSE WITH MORE EXTENSIVE ALCOHOL INVOLVEMENT IN PARTICULAR, REPORT ALCOHOLIC SYMPTOMATOLOGY IN FOUR INDEPENDENT WAYS WITH REFERENCE TO THE OBTAINED DIMENSIONS. THREE DIMENSIONS OF ALCOHOLIC SYMPTOMATOLOGY ARE HELP-SEEKING, DISCORD, ALIENATION, AND DENIAL. CONSEQUENTLY, A UNIDIMENSIONAL DESCRIPTION OF ALCOHOL INVOLVEMENT UNDERESTIMATES THE VARIETY OF INFORMATION AFFORDED BY THE MAST. WITH REGARD TO THE NONALCOHOLIC DWI OFFENDERS, THE MAST MAY BE ILL EQUIPPED TO DIFFERENTIATE BETWEEN THE

PREVAILING SYMPTOM PATTERNS, AMONG WHICH ARE MILD OR OCCASIONAL KINDS OF DIFFICULTY.

by BURTON J. ZUNG  
Publ: JOURNAL OF STUDIES ON ALCOHOL V39 N1 P56-67 (1978)  
1978; 23REFS  
SPONSORED, IN PART, BY NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION, AND TEXAS GOVERNOR'S OFFICE OF TRAFFIC SAFETY.  
Availability: SEE PUBLICATION

HS-022 649

#### **FEASIBILITY OF DETERMINING BLOOD ALCOHOL CONCENTRATIONS IN SOCIAL DRINKING SETTINGS**

A PILOT STUDY WAS CONDUCTED TO DETERMINE THE FEASIBILITY OF OBTAINING DATA ON THE BLOOD ALCOHOL CONCENTRATIONS (BAC'S) OF REPRESENTATIVE SAMPLES OF PERSONS IN A VARIETY OF PUBLIC AND PRIVATE DRINKING SETTINGS. PRESENTLY THERE IS NO CATALOG OF THE BAC'S TYPICALLY PRODUCED IN VARIOUS DRINKING SETTINGS (E.G. COCKTAIL PARTIES, DINNER PARTIES, AND PUBLIC DRINKING ESTABLISHMENTS), ALTHOUGH SUCH INFORMATION COULD BE USEFUL IN DESIGNING MEASURES TO REDUCE THE FREQUENCY WITH WHICH INTOXICATED PERSONS USE THE NATION'S ROADS. OUT OF 117 PERSONS APPROACHED AFTER THEY HAD EXITED FROM A PUBLIC DRINKING ESTABLISHMENT OR A PRIVATE RESIDENCE, 80 AGREED TO BE INTERVIEWED BY PERSONS WORKING IN THE PILOT STUDY AND 60 OF THE 80 AGREED TO PROVIDE A BREATH SAMPLE. INCLUDED AMONG THE 37 NON-RESPONDENTS WERE A NUMBER OF PERSONS WHOM INTERVIEWERS ATTEMPTED TO APPROACH BUT WHO REFUSED TO STOP OR OTHERWISE IGNORED THE INTERVIEWERS. FIFTY-EIGHT OF THE 60 TESTED HAD BEEN DRINKING, 15 MEN HAVING BAC'S EQUAL TO OR GREATER THAN 0.100%, 18 MEN AND 5 WOMEN HAVING BAC'S OF 0.050% TO 0.099%, AND 16 MEN AND 4 WOMEN HAVING BAC'S OF 0.001% TO 0.049%. ONE MAN AND ONE WOMAN HAD NO MEASURABLE BAC. TWO THIRDS OF THE BREATH SAMPLES WERE OBTAINED FROM PERSONS LEAVING PUBLIC DRINKING ESTABLISHMENTS AND ONE THIRD FROM PERSONS LEAVING PRIVATE RESIDENCES, ALTHOUGH THE RESPONSE RATE AT PUBLIC AND PRIVATE DRINKING LOCATIONS (48% VERSUS 54%) WAS APPROXIMATELY THE SAME. ALL BAC'S EQUAL TO OR GREATER THAN 0.100% WERE FOUND AMONG THOSE LEAVING PUBLIC DRINKING ESTABLISHMENTS. THERE WAS NO SUBSTANTIAL DIFFERENCE IN THE PERCENTAGE OF PERSONS PROVIDING BREATH SAMPLES AFTER BEING APPROACHED BY CONSPICUOUS AND INCONSPICUOUS INTERVIEWERS (55% VERSUS 48%). OF POTENTIAL RESPONDENTS, 73% OF THE MEN AND 56% OF THE WOMEN GAVE INTERVIEWS AND 58% OF THE MEN AND 29% OF THE WOMEN PROVIDED BREATH SAMPLES.

by ALLAN F. WILLIAMS  
Publ: JOURNAL OF STUDIES ON ALCOHOL V39 N1  
P201-6 (1978)  
1978; 19REFS  
Availability: SEE PUBLICATION

August 31, 1978

HS-022 652

HS-022 650

**PLANNING FOR THE AUTOMOBILE IN THE SCAG [SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS] REGION. AN EVALUATION OF ALTERNATIVES FOR REDUCING AUTOMOBILE EMISSIONS AND FUEL CONSUMPTION**

A ONE-YEAR ANALYSIS OF ALTERNATIVES FOR REDUCING AUTOMOTIVE EMISSIONS AND FUEL CONSUMPTION IN SOUTHERN CALIFORNIA COVERED A VARIETY OF REGULATORY TECHNIQUES, SUCH AS MANDATORY INSPECTION AND MAINTENANCE, EMISSIONS AND FUEL ECONOMY STANDARDS, EMERGENCY SMOG CONTROLS, AND GASOLINE RATIONING. SEVERAL PRICING MECHANISMS WERE ALSO STUDIED, INCLUDING GASOLINE TAXES, PARKING SURCHARGES, AND VEHICLE REGISTRATION TAXES. TRAFFIC CONTROL MEASURES, SUCH AS RAMP METERING, PREFERENTIAL LANES, AND SIGNAL SYNCHRONIZATION, WERE ALSO CONSIDERED. THE RESULTS OF THE STUDY SHOW THAT GASOLINE TAX INCREASES, PARKING TAXES, AND PARKING SUPPLY RESTRICTIONS ARE RELATIVELY INEFFECTIVE IN REDUCING AUTOMOBILE TRIPS AND VEHICLE MILES OF TRAVEL. THE STUDY ALSO CONCLUDES THAT UNDER CERTAIN CONDITIONS RAMP METERING AND PREFERENTIAL LANES MAY RESULT IN A NET INCREASE IN EMISSIONS AND FUEL CONSUMPTION. THE MOST ATTRACTIVE PROGRAM OF ALL THOSE STUDIED IS MANDATORY INSPECTION AND MAINTENANCE (I/M). I/M HAS SHOWN TO BE AN EFFECTIVE STRATEGY FOR REDUCING EMISSIONS AT RELATIVELY LOW COST; FURTHERMORE, IT HAS A NEGLIGIBLE IMPACT ON MOBILITY AND ACCESSIBILITY, UNLIKE "DISINCENTIVES," SUCH AS EMISSION TAXES AND PARKING RESTRICTIONS. THE POLITICAL FEASIBILITY OF DISINCENTIVES IN THE SCAG (SOUTHERN CALIFORNIA ASSOC. OF GOVERNMENTS) REGION IS LOW. PERHAPS THE MOST IMPORTANT REASON IS THAT PERSONAL LIFESTYLES ARE AFFECTED BY MANY OF THE ALTERNATIVES. UNTIL THERE IS A WILLINGNESS OR COMMONLY PERCEIVED NEED TO ACCEPT RESTRICTIONS ON MOBILITY AND ACCESSIBILITY, AUTO RESTRAINTS WILL PROBABLY NOT BE IMPLEMENTED IN THE SCAG REGION.

SOUTHERN CALIFORNIA ASSOC. OF GOVERNMENTS,  
600 S. COMMONWEALTH AVE., SUITE 1000, LOS  
ANGELES, CALIF. 90005  
FHWA-CA-09-0046  
Rept. No. PB-271 570; 1976; 102P 36REFS  
Availability: NTIS

HS-022 651

**WHAT'S NEW WITH COE'S [CABS-OVER-ENGINES]**

REFINEMENTS OF THE SUSPENDED-CAB CONCEPT AS A GROWING TREND IN COE (CAB-OVER-ENGINE) DESIGNS FOR TRUCKS ARE DISCUSSED. THE PURPOSE OF A CAB SUSPENSION IS TO ISOLATE THE DRIVER COMPARTMENT FROM THE VEHICLE CHASSIS. THESE SUSPENSION SYSTEMS MAY INCLUDE COIL SPRINGS, SHOCK ABSORBERS, EVEN ANTIROLL BARS. YET IN COE DESIGNS, THEY MUST ALSO BE

COMPATIBLE WITH CAB TILTING NECESSARY FOR ENGINE ACCESS. DESIGN OPTIONS INCLUDE THREE-POINT OR FOUR-POINT MOUNTING, AND TORSION-BAR OR HYDRAULIC TILT. THE TOTAL PACKAGE MUST ATTENUATE UNWANTED VIBRATIONS, BE DURABLE AND EASILY MAINTAINED, AND DO ALL THIS COST-EFFECTIVELY. THE IDEAL CAB SUSPENSION WOULD BE BASED ON A THREE-POINT LAYOUT WITH ITS SINGLE CONNECTION AT THE FRONT OF THE CHASSIS. HOWEVER, THIS IS GENERALLY IMPRACTICAL WITH COE'S BECAUSE OF LOAD-BEARING REQUIREMENTS WHEN A CAB IS TILTED FORWARD. USUALLY FOUR-POINT MOUNTINGS OR SINGLE REAR MOUNTS ARE CHOSEN. THE INTEGRATION OF CAB SUSPENSIONS WITH COE TILT REQUIREMENTS DEPENDS ON CAREFUL DESIGN AND EVALUATION FOR OPTIMUM RIDE QUALITY. TORSION-BAR TILTING IS USUALLY THE SIMPLEST, LEAST EXPENSIVE, AND LIGHTEST METHOD OF CAB TILTING; BUT IT IS ALSO THE MOST AFFECTED BY OUTSIDE INFLUENCES (E.G. A ROAD INCLINE, STRONG WIND, EXTRA CAB WEIGHT) WHICH CAN SUBSTANTIALLY INCREASE THE MANUAL EFFORT REQUIRED. HYDRAULIC SYSTEMS ARE MORE COMPLICATED, HEAVIER, MORE COSTLY, AND HAVE HIGHER MAINTENANCE REQUIREMENTS; BUT THEY ARE ALSO EASIER TO OPERATE AND ARE ESSENTIALLY UNAFFECTED BY OUTSIDE INFLUENCES. SUSPENDED CABS HAVE REPLACED DIRECT FRONT MOUNTING IN MANY APPLICATIONS. CAB HINGES RIDE ON COIL SPRINGS CONCENTRIC ABOUT SHOCK ABSORBERS; ANTIROLL BARS MAY ALSO BE FITTED TO RAISE THE SUSPENSION'S ROLL STIFFNESS. CAB SUSPENSIONS AT THE REAR FEATURE COIL SPRINGS AND SHOCK ABSORBERS WHICH SUSPEND A CAB SUPPORT BEAM CARRYING THE LOCKING HARDWARE.

Publ: AUTOMOTIVE ENGINEERING V86 N3 P60-3 (MAR 1978)  
1978

BASED ON SAE-780407 "A PRACTICAL APPROACH TO CAB SUSPENSION," BY R. WILD, PRESENTED AT THE SAE CONGRESS, DETROIT, 27 FEB-3 MAR 1978.

Availability: SEE PUBLICATION

HS-022 652

**ARAMIDS AND POLYIMIDES DIRECT-FORM INTO HIGH-PERFORMANCE PLASTICS**

ARAMIDS AND POLYIMIDES, NEW OPTIONS FROM DUPONT IN HIGH-PERFORMANCE PLASTICS, ARE COMPARED TO TRADITIONAL POLYMERS AND SOME DESIGN GUIDELINES FOR THEIR DIRECT-FORMING TECHNIQUE ARE PRESENTED. RESULTS FROM TESTING INDICATE THAT ARAMIDS (KS-105, KS-205, KS-305) AND POLYIMIDES (SP-1, SP-21, SP-22, SP-211, SP-8, SP-811) COMPARE FAVORABLY WITH PHENOLIC, NYLON, PTFE, AND ACETAL MATERIALS. THE HIGHEST CONTINUOUS TEMPERATURE FOR ARAMIDS AND POLYIMIDES IS 260° C; POLYIMIDES CAN SUPPORT LOADS WITH INTERMITTENT EXCURSIONS AS HIGH AS 482° C. IN GENERAL, ARAMIDS AND POLYIMIDES HAVE HIGHER TENSILE STRENGTHS THAN THOSE OF TRADITIONAL OPTIONS. ARAMIDS ARE SIGNIFICANTLY STIFFER THAN POLYIMIDES, AND THE LATTER TEND TO EX-

HIBIT HIGHER MODULI THAN TRADITIONAL MATERIALS. THESE NEW PLASTICS LIE BETWEEN METALS AND TRADITIONAL POLYMERS IN RELATION TO THERMAL EXPANSION. WITH RESPECT TO CREEP, A 12% GRAPHITE-FILLED ARAMID EXHIBITED ONLY 0.6% CREEP AFTER 10,000 HOURS AT 17-MPA (2500 PSI) FLEX STRESS AND 200° C (COMPARED TO ABOUT 1% CREEP FOR A TYPICAL NYLON REINFORCED WITH 30% GLASS), AND A POLYIMIDE FILLED WITH 15% GRAPHITE SHOWED ONLY 1% CREEP AFTER 1000 HOURS AT 300° C. BOTH ARAMIDS AND POLYIMIDES COMPARE FAVORABLY TO TRADITIONAL OPTIONS WITH RESPECT TO PV (PRESSURE-VELOCITY) CURVES. ARAMIDS AND POLYIMIDES ARE RECOMMENDED FOR SERVICE IN A WIDE VARIETY OF THE ENVIRONMENTS TO WHICH AUTOMOTIVE COMPONENTS ARE EXPOSED, EVEN AT ELEVATED TEMPERATURE. IN TESTS, THE ONLY CHEMICAL MEDIA ESPECIALLY AGGRESSIVE TO THESE PLASTICS WERE DIMETHYL ACETAMIDE, DIMETHYL FORMAMIDE, STRONG BASES, AND CONCENTRATED ACIDS; IN ADDITION, BOTH MATERIALS ABSORB MOISTURE WHEN EXPOSED TO HUMIDITY OR IMMERSED IN WATER, IN THE MANNER OF OTHER PLASTICS. ARAMID AND POLYIMIDE PARTS CAN BE MOLDED DIRECTLY IN A MANNER SIMILAR TO P/M TECHNIQUES, OR THEY CAN BE MACHINED FROM STOCK SHAPES. SOME DESIGN GUIDELINES FOR DIRECT FORMING OF PARTS INCLUDE THE FOLLOWING: AVOID FEATHER EDGES; AVOID NARROW, DEEP SPLINES; AND USE ROUND VS. SHARP CORNERS. SOME APPLICATIONS OF ARAMIDS/POLYIMIDES INCLUDE THRUST WASHERS, ROTARY SEAL RINGS, AND BUSHINGS AND BEARINGS.

Publ: AUTOMOTIVE ENGINEERING V86 N3 P56-9 (MAR 1978)  
1978  
BASED ON SAE-780358 "ADVANCED CONCEPTS IN AUTOMOTIVE WEIGHT REDUCTION USING HIGH PERFORMANCE PLASTICS," BY RICHARD F. WAUGHTAL, PRESENTED AT THE SAE CONGRESS, DETROIT, 27 FEB-3 MAR 1978.  
Availability: SEE PUBLICATION

HS-022 653

### TESTS CONFIRM FORMABILITY OF DUAL-PHASE, HIGH-STRENGTH STEEL SHEET

RESULTS OF FORMABILITY TESTS AND STAMPING TRIALS OF A NEW DUAL-PHASE, HIGH-STRENGTH STEEL NAMED HI-FORM 80D ARE PRESENTED. THE LABORATORY FORMABILITY STUDIES INCLUDED FORMING LIMIT DIAGRAM (FLD), LIMITING DOME HEIGHT (LDH), HOLE EXPANSION, AND STRETCH BAND (SBT) TESTS. TWO CRITERIA WERE USED TO SELECT PARTS FOR EVALUATION IN THE STAMPING TRIALS; THE PARTS MUST ENCOMPASS THE RANGE OF STRAIN STATES TYPICAL OF AUTOMOTIVE STAMPINGS, AND THEY MUST REPRESENT BODY COMPONENTS WHICH CAN POSSIBLY UTILIZE HIGH STRENGTH STEEL AT REDUCED GAUGE TO ACHIEVE A WEIGHT REDUCTION. THE LABORATORY ANALYSIS OF MATERIAL FORMABILITY WAS CONFIRMED BY THE STAMPING TRIALS, WHICH SHOWED A FORMABILITY SIMILAR TO THAT FOR BODY SHEET

ALUMINUM. WHILE THE HI-FORM 80D WAS FOUND TO POSSESS GOOD FORMABILITY FOR ITS AS-RECEIVED STRENGTH LEVEL, THE STAMPING TRIALS SHOW THAT SOME CONCESSIONS IN PART SHAPE WILL BE REQUIRED TO ACCOMMODATE THE REDUCED FORMABILITY OF HI-FORM 80D RELATIVE TO AK STEEL.

Publ: AUTOMOTIVE ENGINEERING V86 N3 P50-5 (MAR 1978)  
1978  
BASED ON SAE-780136 "EVALUATION OF A NEW, DUAL PHASE, COLD ROLLED STEEL: MECHANICAL PROPERTIES, AGING RESPONSES, AND WELDABILITY," BY T. E. FINE, R. V. FOSTINI, B. S. LEVY, A. G. PREBAN, AND R. STEVENSON; AND SAE-780137 "EVALUATION OF A NEW DUAL PHASE, COLD ROLLED STEEL: FORMABILITY," BY WILLIAM G. BRAZIER AND ROBIN STEVENSON (BOTH PAPERS PRESENTED AT SAE CONGRESS, DETROIT, 27 FEB-3 MAR 1978).  
Availability: SEE PUBLICATION

HS-022 654

### AUTO ADHESIVES: WHY, HOW, AND WHERE

THE SELECTION AND APPLICATION OF ADHESIVES FOR AUTOMOTIVE COMPONENTS ARE DISCUSSED. ADHESIVES ARE FINDING INCREASED AUTOMOTIVE APPLICATION BECAUSE OF THEIR BOND PERFORMANCE, DURABILITY, AND ECONOMY. BASIC STEPS IN THE SELECTION PROCESS FOR THESE MATERIALS (EPOXIES, POLYESTERS, URETHANES, CYANOACRYLATES, SILICONES, SOLVENT CEMENTS) INCLUDE THE FOLLOWING: DEFINING THE PHYSICAL AND CHEMICAL ENVIRONMENT, DETERMINING MECHANICAL AND THERMAL STRESSES, ESTABLISHING MINIMUM REQUIREMENTS FOR PERFORMANCE AND DURABILITY, AND TESTING AND EVALUATING THE BONDED ASSEMBLIES. ADHESIVE BONDS PROFIT FROM THE FOLLOWING SPECIAL DESIGN GUIDELINES: MAXIMIZE THE BOND AREA, DESIGN FOR EACH PREPARATION OF THE SURFACE, AND PROTECT BOND LINES FROM CLEAVAGE AND THE ENVIRONMENT. SOME PRESENT AUTOMOTIVE APPLICATIONS OF ADHESIVE BONDING INCLUDE BONDED BRAKE SHOES, BODY PANELS, REARVIEW MIRRORS, VINYL ROOFS, TRIM AND SCRIPT, CARPETING, GASKETS, CASTINGS, AND LAMP LENSES.

Publ: AUTOMOTIVE ENGINEERING V86 N3 P46-9 (MAR 1978)  
1978; 1 REF  
BASED ON SAE-780191 "AUTOMOTIVE ADHESIVES: WHY, HOW, WHAT, WHERE," BY GERALD L. SCHNEBERGER, PRESENTED AT SAE CONGRESS, DETROIT, 27 FEB-3 MAR 1978.  
Availability: SEE PUBLICATION

HS-022 655

### A PRIMER ON FORMING ALUMINUM SHEET

SOME NECESSARY CONSIDERATIONS FOR THE SUCCESSFUL FORMING OF BUMPERS AND BODY PANELS FROM ALUMINUM SHEET ARE DISCUSSED. THE PART DESIGN PARAMETERS FOR BUMPERS THAT HAVE TO BE CONSIDERED INCLUDE THE FOLLOWING:

CENTER PEAK DEPTH, TOP AND BOTTOM FLANGE WIDTH, CORNER BEND RADIUS, END WRAP DEPTH, ENTRY ANGLE, NOSE RADIUS, TRANSITION AREAS, TAKE-UP POCKETS, SLOPE OF TOP AND BOTTOM FLANGE, OFFSET, BEND RADIUS, DOWNFLANGE LENGTH, REAR FLANGE OPENING, AND BUMPER HEIGHT. CRITICAL PART DESIGN FEATURES INCLUDE THE FOLLOWING: MAINTAINING A 1:1 RATIO BETWEEN THE CORNER FLANGE WIDTH AND CORNER RADIUS, HOLDING THE CENTER PEAK DEPTH TO LESS THAN 60% OF THE TOP CENTER FLANGE WIDTH, KEEPING CORNER OFFSET TO APPROXIMATELY 2-3 CM, AND UTILIZING TAKE-UP POCKETS ON FLANGES AT CORNER BEND AREAS. ONCE A BUMPER DESIGN HAS BEEN FIXED, SUCCESSFUL FORMING DEPENDS ON CAREFUL CONSIDERATION OF BINDER LINE AND DIE CAVITY DESIGN AND ON BLANK DEVELOPMENT. CRITICAL TOOLING PARAMETERS INCLUDE THE FOLLOWING: CONTOURING THE BINDER LINE TO CONFORM TO THE PUNCH FACE, SLOPING THE ENDS OF THE BINDER TO PROMOTE METAL FLOW, USING ONLY THAT BLANK HOLDER PRESSURE NECESSARY TO CONTROL WRINKLES, HAVING PROPER CLEARANCES AT SPECIFIC POINTS TO ALLOW SUBSTANTIAL METAL THICKENING, HAVING PROPER BLANK DEVELOPMENT, AND HAVING GOOD LUBRICATION. AN UNDERSTANDING OF THE FORMABILITY DIFFERENCES BETWEEN ALUMINUM AUTO BODY SHEET AND DRAWING QUALITY STEEL IS ESSENTIAL TO SUCCESSFUL HIGH SPEED ALUMINUM PANEL PRODUCTION. THE DRAWABILITY OF TYPICAL SHALLOW DRAWN ALUMINUM AUTO BODY PANELS WILL BE EQUAL TO DRAWING QUALITY STEEL IN TOOLS WHICH INCORPORATE ALUMINUM DESIGN GUIDELINES. STRETCHABILITY IS LESS FOR ALUMINUM THAN FOR STEEL DUE TO LOWER TOTAL ELONGATION, LESS ABILITY TO DISTRIBUTE LOCAL STRAIN, AND A LOWER FORMING LIMIT CURVE. LUBRICATION REQUIREMENTS ARE GREATER WITH ALUMINUM, WHICH IS SUPPLIED DRY AND HAS A THIN NATURAL LAYER OF ALUMINUM OXIDE ON ITS SURFACES. SINCE ALUMINUM PANELS HAVE MORE SPRINGBACK THAN STEEL, ADDITIONAL OVERCROWN CAN BE BUILT INTO THE INITIAL DRAW DIE. BENDING AND HEMMING CAPABILITIES ARE LOWER FOR ALUMINUM OUTER PANEL ALLOYS AND ROPE HEMMING IS USED TO PREVENT CRACKING.

Publ: AUTOMOTIVE ENGINEERING V86 N3 P36-45 (MAR 1978)  
1978

BASED ON SAE-780141 "FORMING HIGH STRENGTH BUMPERS FROM ALUMINUM SHEET," BY L. C. BLAYDEN AND J. E. PARNELL; AND SAE-780392 "INTERRELATION BETWEEN PART AND DIE DESIGN FOR ALUMINUM AUTO BODY PANELS," BY N. P. WOLFF (BOTH PAPERS PRESENTED AT SAE CONGRESS, DETROIT, 27 FEB-3 MAR 1978).  
Availability: SEE PUBLICATION

HS-022 656

## MOTORCYCLE FACTS, NOVEMBER, 1977

STATISTICS ON MOTORCYCLE ACCIDENTS IN THE U.S. DURING 1976 AND INFORMATION ON MOTORCY-

CLE SAFETY IN GENERAL ARE PRESENTED. DATA ARE PRESENTED ON THE FOLLOWING ASPECTS OF MOTORCYCLE (TO INCLUDE MOTOR SCOOTERS AND MOTORIZED BICYCLES) ACCIDENTS: TYPES OF MOTOR VEHICLES INVOLVED; MOTORCYCLE RIDER DEATHS; SEVERITY OF ACCIDENTS; TYPES OF ACCIDENTS; DIRECTIONAL ANALYSIS; CONTRIBUTING CIRCUMSTANCES; TIME AND DAY OF WEEK AND MONTH; ROADS AND WEATHER; AGE, SEX, RESIDENCE OF OPERATOR; PASSENGERS; EXPERIENCE OF OPERATOR; PART OF BODY INJURED; MAKE AND WEIGHT OF MOTORCYCLE; MOTOR SCOOTER ACCIDENTS, AND OFF-ROAD VEHICLES. IN SUMMARY, MOTORCYCLES COMPRISED 3.6% OF THE TOTAL VEHICLE REGISTRATIONS IN 1976, REPRESENTED 1.5% OF THE TOTAL NUMBER OF VEHICLES IN ALL MOTOR VEHICLE ACCIDENTS, AND REPRESENTED 5.4% OF ALL VEHICLES INVOLVED IN FATAL ACCIDENTS (WITH A TOTAL OF 3000 DEATHS OF OPERATORS AND PASSENGERS OF MOTORCYCLES). INFORMATION IS ALSO GIVEN ON SAFE MOTORCYCLE OPERATION, HELMETS, FACE AND EYE PROTECTION, CLOTHING, INSTRUCTION AND LICENSING, INSURANCE, THE NATIONAL SAFETY COUNCIL'S DDC MOTORCYCLE SUPPLEMENT (DEFENSIVE DRIVING COURSE), AND MOTORCYCLE LEGISLATION.

NATIONAL SAFETY COUNCIL, STATISTICS DEPT., 444 N. MICHIGAN AVE., CHICAGO, ILL. 60611  
1977; 11P 27REFS  
Availability: CORPORATE AUTHOR

HS-022 657

## NEW IGNITION SYSTEM ELIMINATES DISTRIBUTOR

A NEW IGNITION SYSTEM DEVELOPED BY FORD MOTOR CO. FIRES PLUGS SELECTIVELY WITHOUT A DISTRIBUTOR. THIS EXPERIMENTAL DISTRIBUTORLESS IGNITION SYSTEM, DIS, USES A DOUBLE-HEADED COIL SENDING OUTPUTS OF OPPOSITE POLARITY TO PLUGS PAIRED IN DIODE-DIRECTED CIRCUITS. COMPARED TO CONVENTIONAL SYSTEMS, DIS OFFERS A SIGNIFICANTLY REDUCED ELECTROMAGNETIC RADIATION, AND EXTENDED RANGE OF SPARK ADVANCE, AND IMPROVED PACKAGING. EACH OF THESE PROPERTIES ADDRESSES AN INHERENT SHORTCOMING OF CONVENTIONAL SPARK DISTRIBUTION. A SPARK'S INITIAL BREAKDOWN, FOR EXAMPLE, OCCURS AT THE DISTRIBUTOR ROTOR, INSIDE AN UNSHIELDED PLASTIC CAP. THIS CAN LEAD TO SIGNIFICANT RADIO FREQUENCY INTERFERENCE (RFI) ABOVE 20 MHZ. THERE ARE FIXES FOR MINIMIZING DISTRIBUTOR RFI, BUT DIS OFFERS A CONCEPTUAL BENEFIT; SPARK BREAKDOWNS OCCUR ONLY AT THE PLUGS THEMSELVES, AND THESE ARE SHIELDED BY THE ENGINE BLOCK. SPARK ADVANCE CAPABILITIES, "ROTOR REGISTRATION" TO SPECIALISTS, ARE BETTER WITH DIS AS WELL. CONVENTIONAL SPARK DISTRIBUTION DEPENDS ON A MECHANICAL DEVICE, THE ROTOR, AND THIS PUTS UNDESIRABLE UPPER BOUNDS ON IGNITION ADVANCE. BY CONTRAST, DIS ADVANCE IS NONMECHANICAL AND MORE THAN SUFFICIENT FOR ADVANCE STRATEGIES. LAST, DIS OFFERS SEVERAL PACKAGING BENEFITS. BY ELIMINATING



THE DISTRIBUTOR, IT FREES UP AS MUCH AS A 10-CM DIAMETER ALONG THE ENGINE BLOCK. ALSO, THERE ARE NO CAP AND ROTOR TO MAINTAIN OR REPLACE, AND THE ENTIRE SYSTEM IS LESS PRONE TO ENVIRONMENTAL PROBLEMS. FORD HAS NO IMMEDIATE PRODUCTION PLANS FOR DIS, ALTHOUGH ITS POTENTIAL USE IN RESPONSE TO ANY TIGHTENING OF RFI LIMITS IS CLEAR. CURRENTLY, THERE ARE NO APPLICABLE FEDERAL STANDARDS; CANADA, HOWEVER, HAS ONE SIMILAR TO SAE J551C THAT WENT INTO EFFECT SEP 1976. DIS WOULD BE A NATURAL COMBINATION WITH FORD'S ELECTRONIC ENGINE CONTROL (EEC) ON FOUR-CYLINDER ENGINES. ITS COMPACTNESS WOULD BE A SMALL-CAR ASSET, AND EEC'S ADVANCE STRATEGIES COULD BE FULLY EXPLOITED. ON THE MINUS SIDE, DIS ATTRACTIVENESS WITH A V-8 NEEDING ADDED ADVANCE IS LESSENED BY THE REQUIREMENT OF TWO SEPARATE COILS AND MODULES. NOR IS DIS COMPATIBLE WITH UNORTHODOX THREE-CYLINDER OR FIVE-CYLINDER POWERPLANTS. ALSO, QUESTIONS OF SPARK PLUG LIFE AND DIODE RELIABILITY REMAIN OPEN.

Publ: AUTOMOTIVE ENGINEERING V86 N3 P69-72 (MAR 1978)

1978  
BASED ON SAE-780327 "A DISTRIBUTORLESS IGNITION SYSTEM: SOLID STATE HIGH VOLTAGE DISTRIBUTION WITH LOW RFI EMISSIONS," BY J. R. ASIK, D. F. MOYER, AND W. G. RADO, PRESENTED AT SAE CONGRESS, DETROIT, 27 FEB-3 MAR 1978.  
Availability: SEE PUBLICATION

HS-022 658

## WINDSHIELD WASH SYSTEMS AND THEIR PUMPS

A REVIEW OF THE PRINCIPAL DESIGN PARAMETERS OF WINDSHIELD WASHER SYSTEMS IS PRESENTED, AND THE NEED FOR THE ESTABLISHMENT OF A EUROPEAN STANDARD FOR SUCH SYSTEMS TO RAISE THEIR EFFICIENCY AND REDUCE THEIR COSTS IS EXPRESSED. VIRTUALLY ALL CARS EITHER HAVE ELECTRIC WINDSHIELD WASHER SYSTEMS OR ARE TO BE OFFERED WITH THEM WITHIN THE NEXT FEW MONTHS. MANUAL AND FOOT-ACTUATED PUMPS ARE NOW GENERALLY BEING RULED OUT. IT IS FELT THAT THE SIZE OF THE RESERVOIR COULD BE INCREASED AND MEANS OF FILLING IT COULD BE IMPROVED. WITH RESPECT TO THE ELECTRIC PUMP, THE TWO PUMPS THAT HAVE THE LOWEST STARTING TORQUE ARE THE RADIAL VANE CENTRIFUGAL AND THE REGENERATIVE TYPES. NEITHER IS SELF-PRIMING, SO EACH HAS TO BE INSTALLED EITHER IN THE BASE OF THE RESERVOIR OR BELOW IT. A CENTRIFUGAL PUMP OFFERS THE ADVANTAGE OF INHERENTLY LIMITED MAXIMUM PRESSURE SO THAT, IN THE EVENT OF A BLOCKED JET, THE PRESSURE RISES ONLY marginally ABOVE NORMAL; HOWEVER, IT HAS THE DISADVANTAGE OF BEING SENSITIVE TO CHANGES IN VISCOSITY. THE VOLUME FLOW OF THE REGENERATIVE PUMP IS NOT SO SENSITIVE TO DELIVERY HEAD AS THAT OF THE CENTRIFUGAL TYPE. THE CENTRIFUGAL PUMP IS MORE EFFICIENT THAN THE REGENERATIVE TYPE. THE FOUR TYPES OF SELF-PRIMING PUMPS ARE THE GEAR, ECCENTRIC ROTOR, PERISTALTIC

AND FLEXIBLE ROTOR TYPES. GIVEN A REQUIREMENT FOR A SELF-PRIMING PUMP, THE BEST CHOICE IS PROBABLY THE ECCENTRIC ROTOR POSITIVE DISPLACEMENT UNIT. AN IMPORTANT CONSIDERATION IS THE VISCOSITY EFFECTS ON PUMPS. WITH A 50/50 MIXTURE OF ISOPROPYL ALCOHOL AND WATER, AN INCREASE IN TEMPERATURE FROM 20° C TO 100° C CAUSES VIRTUALLY NO CHANGE IN THE PERFORMANCE OF THE CENTRIFUGAL PUMP. AT THE LOWER TEMPERATURE, HOWEVER, THE KINEMATIC VISCOSITY OF THE FLUID INCREASES CONSIDERABLY; ALTHOUGH THIS HAS LITTLE EFFECT ON THE GEAR OR ECCENTRIC ROTOR TYPES, AT -19° C IT CAN REDUCE THE OUTPUT OF BOTH THE CENTRIFUGAL AND FLEXIBLE ROTOR TYPE PUMPS BY ABOUT 50%. THE ONLY EXISTING STANDARD FOR WINDSHIELD WASHER SYSTEMS IS THE SAE J942B TEST SPECIFICATION WHICH IS OUTDATED AND CONTAINS SOME ANOMALIES. A TEST OF THE EFFICIENCY OF THE WASHER SYSTEM ALONE (VERSUS INCLUDING THE WIPER IN THE TESTING) IS REQUIRED. THE IMPORTANT PARAMETERS TO BE TESTED ARE THE RESERVOIR CAPACITY, THE MASS AND VELOCITY OF FLOW ISSUING FROM THE JETS, AND THE ACCURACY WITH WHICH THEY ARE AIMED AT THE WINDSHIELD.

by KEN GARRETT

Publ: AUTOMOTIVE ENGINEER V2 N6 P15-7 (DEC 1977)

1977  
Availability: SEE PUBLICATION

HS-022 659

## ENGINE DESIGN SERIES: FUEL SYSTEMS--DIESEL

THE OPERATING PRINCIPLES AND DESIGN CHARACTERISTICS OF CURRENT DIESEL FUEL INJECTION PUMPS AND INJECTORS ARE DISCUSSED. RECENT DEVELOPMENTS HAVE BEEN AIMED AT REDUCING SMOKE AND NOISE WHILE PROVIDING A CLOSE MATCH WITH THE CHARACTERISTICS OF TURBOCHARGERS. THERE ARE ALSO TRENDS TO USE MORE PRECISE GOVERNOR CHARACTERISTICS FOR SMALLER ENGINES, AND HIGHER-PRESSURE INJECTION FOR LARGER ONES. THE TWO BASIC TYPES OF PUMPS ARE THE IN-LINE AND ROTARY. THE ESSENTIAL DIFFERENCE BETWEEN THEM IS THAT IN THE IN-LINE PUMP THERE IS A SEPARATE PUMPING ELEMENT FOR EACH CYLINDER, WHEREAS THE ROTARY PUMP GENERALLY HAS ONLY ONE PUMPING ELEMENT, THE FUEL BEING DELIVERED THROUGH A DISTRIBUTOR SYSTEM TO THE INJECTORS. ROTARY PUMPS ARE MORE COMPACT AND LIGHTER THAN IN-LINE PUMPS, WHILE ADVANCE/RETARD TIMING DEVICES CAN BE INCORPORATED MORE EASILY THAN IN IN-LINE PUMPS. HOWEVER, THEIR OUTPUT PRESSURE IS NORMALLY LIMITED TO LESS THAN 750 BAR. IN-LINE PUMPS CAN OPERATE AT MUCH HIGHER PRESSURES, THE LATEST UNITS HAVING BEEN DESIGNED FOR OPERATION AT 1000 BAR. IT IS THE COMBINATION OF PRESSURE AND TIMING CHARACTERISTICS THAT NORMALLY DICTATES THE TYPE OF PUMP USED. WITH INDIRECT INJECTION (IDI) THE AIR FLOW IS HIGHLY TURBULENT IN THE PRECHAMBER, SO THAT A RELATIVELY LOW PRESSURE IS ADEQUATE, THE TURBULENCE MIXING THE

FUEL WITH THE AIR TO ENABLE COMBUSTION TO TAKE PLACE. HOWEVER, THE TIMING NORMALLY NEEDS TO BE ALTERED WITH SPEED AND LOAD; THEREFORE, ROTARY INJECTION PUMPS ARE NORMAL ON IDI ENGINES. WITH DIRECT INJECTION (DI) ENGINES THE AIRFLOW IS LESS TURBULENT, BUT THERE IS LESS NEED FOR ALTERATION IN TIMING SO HIGHER PRESSURES ARE NEEDED. IN ADDITION, WITH TURBOCHARGED ENGINES IT IS NECESSARY TO TAKE STEPS TO CONTROL THE THERMAL STRESSES. IN PRACTICE, VIRTUALLY ALL CAR DIESEL ENGINES ARE EQUIPPED WITH ROTARY INJECTION PUMPS WHILE THE MAJORITY OF DI ENGINES HAVE IN-LINE PUMPS. THERE HAS BEEN A TREND TOWARDS THE USE OF MORE IN-LINE PUMPS MAINLY BECAUSE, UNTIL RECENTLY, ROTARY PUMPS WERE UNSUITABLE FOR USE WITH TURBOCHARGED ENGINES AS THEY DID NOT INCORPORATE THE NECESSARY BOOST CONTROL. FOR IDI ENGINES, THE BOSCH VA AND VE AND THE CAV DPA PUMPS ARE THE MOST POPULAR, WHILE SIGMA AND AMERICAN BOSCH ROTARY PUMPS ARE USED ON SOME LARGER ENGINES, AND CAV HAS RECENTLY INTRODUCED ITS D015 UNIT. THE CURRENT IN-LINE PUMP DESIGNS BY CAV ARE THE MINIMEC, THE MAJORMEC, AND THE MAXIMEC. THE LATEST BOSCH DESIGN IS THE MW. DIESEL FUEL INJECTORS CONSIST BASICALLY OF A SPRING-LOADED NEEDLE VALVE IN A BODY. FOR IDI ENGINES, THE PINTLE NOZZLE INJECTOR IS USED. THE PINTLE AT THE END OF THE NEEDLE VALVE PROJECTS THROUGH THE ORIFICE, SO THAT WHEN IT IS RAISED A NARROW SPRAY IS INJECTED. IN SOME CASES, A REVERSE CONICAL NOSE IS INCORPORATED TO GIVE A WIDER SPRAY. FOR DI ENGINES, A NEEDLE VALVE WITH A CONICAL NOSE IS COMBINED WITH A MULTIHOLE INJECTOR BODY, USUALLY CONTAINING FOUR OR FIVE HOLES, WHICH DISTRIBUTE THE FUEL INTO THE TOROIDAL CAVITY IN THE PISTON. IN THE FUTURE, THERE WILL BE A WIDER USE OF VERY SLIM INJECTORS, WITH LOW-MASS NEEDLE VALVES, AND MUCH QUIETER OPERATION. WITH INJECTION PUMPS, THE NEXT STEP IS THE USE OF ELECTRONIC GOVERNOR CONTROL AND EVEN HIGHER INJECTION PRESSURES, UP TO 1300 BAR.

by JOHN HARTLEY

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HS-022 660

## ANTI-CORROSIVE PROTECTION OF CARS

EXTERNALLY APPLIED ANTICORROSIVE COATINGS ARE ONE OF THE FOLLOWING FOUR TYPES: WAX COMPOUNDS, BITUMEN COMPOUNDS, RUBBER COMPOUNDS, AND PLASTIC COATINGS. WAX COMPOUNDS ARE GENERALLY THIXOTROPIC AND BUILD UP TO ABOUT 1 MM THICKNESS. THE COVERING SHOULD NEVER SET HARD, SO THERE SHOULD BE NO DANGER OF AGE-EMBRITTLMENT. MANY OF THE PROPRIETARY COMPOUNDS HAVE GOOD ABRASION RESISTANCE AND ARE PARTIALLY SELF-HEALING SO THAT THERE IS SOME FLOW BACK INTO

AREAS PARTLY ERODED BY SLUSH AND GRIT, BUT THEIR PENETRATION INTO BODY SEAMS AND NOOKS AND CRANNIES IS POOR. PROVIDED THEY COME FROM THE SAME FAMILY GROUP IT IS POSSIBLE TO KEY SUBSEQUENT COATS INTO OLDER ONES. THE CHEAPEST COMPOUNDS ARE BITUMINOUS, BUT OFFER VERY POOR RESISTANCE TO FUEL LEAKS AND ARE SOFTENED AND REMOVED BY OIL AND GREASE SPATTERING. MOST OF THE FACTORY-APPLIED COMPOUNDS EVENTUALLY AGE HARDEN AND CRACK DUE TO OXIDATION. MANY MANUFACTURERS APPLY THEM AS TOO THICK A LAYER AND THEN DURING STOVING THEY SHRINK AND GET A BRITTLE OUTER SKIN. WHEN AGE CRACKING AND PARTIAL SEPARATION FROM THE SHEET METAL OCCUR, ALL LOOSE, CRACKED, AND IMPROPERLY KEYED MATERIAL MUST BE REMOVED COMPLETELY AND MAJOR SECTIONS WILL THEN NEED RETREATMENT. RUBBER-BASED COMPOUNDS, WHEN PROPERLY APPLIED, NEITHER AGE CRACK OR SHRINK, HAVE GOOD EROSION RESISTANCE, AND GIVE EXCELLENT ANTICORROSIVE PROTECTION. HOWEVER, THEY ARE SIGNIFICANTLY MORE EXPENSIVE THAN BITUMEN-BASED PRODUCTS. IT IS POSSIBLE TO EXTEND SERVICE LIFE BY APPLYING A SUPPLEMENTARY COATING OVER THE ORIGINAL ONE. PLASTIC COATINGS ARE AESTHETICALLY MORE PLEASING, DURABLE, AND OFFER GOOD CORROSION/EROSION RESISTANCE, BUT THEY CANNOT BE EASILY REPAIRED AS THEY ARE CURED BY FAIRLY HIGH STOVING TEMPERATURES DURING THE PAINTING OF THE BODY. THE INTERNAL PROTECTION OF HOLLOW SECTIONS, OVER AND ABOVE PHOSPHATING AND PRIMER COAT APPLICATION DURING THE PAINTING PROCESS, IS GENERALLY ENTRUSTED TO PETROLEUM-BASED OR WAX-BASED COMPOUNDS. AN INHERENT PROBLEM WITH INTERNAL TREATMENT IS THAT THE COMPOUNDS ARE APPLIED AS THIN PROTECTIVE FILMS AND WILL NOT ADHERE TO SURFACES COVERED BY LOOSE DIRT AND DUST, OIL, PARAFFIN, OR SILICONES, FOR THEY DO NOT REACT CHEMICALLY WITH PAINT OR METAL BUT ADHERE PURELY BY THE ACTIVE POLAR ATTRACTION AGENTS CONTAINED IN THEIR FORMULATIONS. OTHER APPLICATION AREAS FOR SPECIAL COMPOUNDS ARE BETWEEN TRIM AND PAINTED PANELS, AND IN THE ENGINE COMPARTMENT. ANODIC PROTECTION (WITH PURE ZINC AND ALUMINUM AS TYPICAL SACRIFICIAL METALS) IS SOMETIMES USED TO ENSURE THAT ONLY THE PROTECTIVE LAYER DISSOLVES SLOWLY IN THE PRESENCE OF SLUSH, SALT, AND MUD AND THUS PREVENTS RUSTING OF THE SHEET STEEL UNDERNEATH. SOME BODY REPAIR PROBLEMS PRESENTED BY THESE PROTECTIVE COATINGS INCLUDE FIRE RISKS AND CHARRING OF PROTECTIVE LAYERS DURING CUTTING AND WELDING, DIFFICULTY IN MATCHING BODY REPAIR METHODS TO FACTORY-APPLIED TECHNIQUES, AND DIFFICULTY IN REAPPLYING FOAM FILLING.

by M. A. JACOBSON

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**FUEL ECONOMY OF THE GASOLINE ENGINE.  
FUEL, LUBRICANT AND OTHER EFFECTS**

A COMPILATION OF PAPERS WHICH DISCUSS VARIOUS FACTORS AFFECTING THE FUEL ECONOMY OF THE GASOLINE ENGINE IS PRESENTED. ALL OF THE CONTRIBUTORS ARE AFFILIATED WITH SHELL RES. LTD. (THORNTON RES. CENTRE, CHESTER, ENGLAND), AND THE ARTICLES ARE WRITTEN FROM THE VIEWPOINT OF AN OIL COMPANY'S RESEARCH ACTIVITIES. THE TOPICS INCLUDE THE EFFECT OF THE PROPERTIES OF OIL PRODUCTS (MAINLY GASOLINE BUT ALSO TO A LESSER EXTENT LUBRICANTS) ON FUEL ECONOMY AND ALSO WITH RELATED EFFECTS (E.G. THE EFFECT OF MIXTURE QUALITY, VEHICLE MAINTENANCE, AND EMISSION CONTROL DEVICES). APPENDICES CONTAIN THE FOLLOWING: A GLOSSARY OF TERMS; SOME STATISTICAL TERMS COMMONLY USED IN CONNECTION WITH THE MEASUREMENT OF FUEL ECONOMY; A GUIDE TO THE PITFALLS INVOLVED WITH MECHANICAL DEVICES FOR THE IMPROVEMENT OF FUEL ECONOMY; A GUIDE TO THE PITFALLS INVOLVED WITH FUEL-ADDITIVE INVENTIONS FOR THE IMPROVEMENT OF FUEL ECONOMY; AND ABBREVIATIONS, UNITS AND CONVERSIONS. A SUBJECT INDEX IS PROVIDED.

by D. R. BLACKMORE, ED.; A. THOMAS, ED.  
SHELL RES. LTD., THORNTON RES. CENTRE,  
CHESTER, ENGLAND  
1977; 278P REFS

INCLUDES HS-022 662--HS-022 672.

Availability: HALSTED PRESS, NEW YORK

HS-022 662

**PRINCIPLES GOVERNING FUEL ECONOMY IN A  
GASOLINE ENGINE**

THE FOLLOWING TOPICS ARE DISCUSSED: FUEL HEATING VALUE, ENGINE EFFICIENCY (THE AIR CYCLE, THE FUEL-AIR CYCLE, SIMULATED ENGINE CYCLES, REASONS FOR DISCREPANCIES BETWEEN AN ACTUAL CYCLE AND AN EQUIVALENT FUEL-AIR CYCLE, PUMPING LOSSES, SPARK TIMING, AND ENGINE MAPPING), VEHICLE EFFICIENCY (TRANSMISSION EFFICIENCY AND DESIGN RATIOS, VEHICLE ROAD LOAD, COLD START, ACCESSORIES, AND EMISSION CONTROLS), AND THE POTENTIAL FOR FUEL ECONOMY GAIN. THE FOLLOWING SPECULATIONS ARE MADE WITH RESPECT TO FUEL CONSUMPTION GAINS IN EUROPEAN GASOLINE-POWERED CARS OVER THE NEXT DECADE: FROM ENGINE DESIGN CHANGES, 20%; FROM GASOLINE DESIGN CHANGES, 5%-10%, ACCORDING TO DRIVING CONDITIONS; FROM ENGINE LUBRICANT CHANGES, ABOUT 3%; FROM TRANSMISSION DESIGN CHANGES, 5%-10%; FROM TRANSMISSION LUBRICANT CHANGES, ABOUT 3%; FROM DESIGN CHANGES OF A GIVEN VEHICLE (WEIGHT, DRAG, TIRES, ACCESSORIES), APPROXIMATELY 10%; FROM ENGINE SIZE AND MODEL MIX CHANGES, APPROXIMATELY 10%;

AND FOR VEHICLE MAINTENANCE PROCEDURES, APPROXIMATELY 5%.

by D. R. BLACKMORE  
SHELL RES. LTD., THORNTON RES. CENTRE,  
CHESTER, ENGLAND  
Publ: HS-022 661, "FUEL ECONOMY OF THE GASOLINE  
ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS,"  
NEW YORK, 1977 P14-43  
1977; 28REFS  
Availability: IN HS-022 661

HS-022 663

**MOTOR GASOLINE AND THE EFFECT OF  
COMPRESSION RATIO ON OCTANE  
REQUIREMENT AND FUEL ECONOMY**

THE PRINCIPAL REQUIREMENTS OF AN ENGINE GASOLINE ARE THE FOLLOWING: SUFFICIENT VOLATILITY TO GIVE INFLAMMABLE MIXTURES UNDER ALL OPERATING CONDITIONS, SMOOTH BURNING WITHOUT KNOCK, GOOD FUEL ECONOMY, MINIMUM DEPOSITS IN THE INLET SYSTEM AND COMBUSTION CHAMBER, AND CLEAN BURNING AND LOW LEVEL OF ATMOSPHERIC POLLUTION. THE FOLLOWING TOPICS ARE SEPARATELY DISCUSSED: VOLATILITY, FUEL VOLATILITY AND ITS EFFECT ON COLD STARTING, HOT FUEL HANDLING, WARM-UP, CARBURETOR ICING, OVERALL VOLATILITY CONSIDERATIONS, ANTIKNOCK PERFORMANCE, CLEANLINESS AND RELIABILITY, AND EXHAUST EMISSIONS. ONE OF THE MOST COMPREHENSIVE STUDIES ON THE EFFECT OF COMPRESSION RATIO ON FUEL ECONOMY (CARIS AND NELSON) IS CITED. IT IS REASONABLE TO SPECULATE THAT, IF, IN FUTURE, COMPRESSION RATIOS ARE INCREASED IN THE SEARCH FOR IMPROVED ECONOMY, THESE INCREASES WILL BE ACCOMPANIED BY CHANGES IN COMBUSTION CHAMBER SHAPE DESIGNED TO IMPROVE THE RATE OF COMBUSTION, BY CHANGES IN MIXTURE STRENGTH AIMED AT OPTIMIZING EFFICIENCY RATHER THAN POWER, AND BY CHANGES IN AXLE RATIO DESIGNED TO MAKE SURE THAT THE ENGINE OPERATES IN THE MOST EFFICIENT REGION UNDER NORMAL EVERYDAY DRIVING CONDITIONS. WITH RESPECT TO THE REFINERY AND THE AUTOMOBILE AS A SINGLE ECONOMIC UNIT, IT IS EXPRESSED THAT ONE SIMPLE AND DIRECT WAY OF IMPROVING ECONOMY (IN TERMS OF MILES PER GALLON) IS TO INCREASE THE COMPRESSION RATIO; BUT THE SAVING ON THE ROAD MAY BE OFFSET BY THE ADDITIONAL ENERGY CONSUMED IN THE REFINERY TO MAKE THE NECESSARY HIGH-OCTANE GASOLINES. THE MOST ATTRACTIVE ROUTE FOR THE FUTURE SEEMS TO BE THE DEVELOPMENT OF HIGH-COMPRESSION-RATIO HIGH-EFFICIENCY ENGINES THAT WILL RUN ON GASOLINES OF CURRENT (OR LOWER) OCTANE QUALITY; IT MAY, HOWEVER, BE DIFFICULT TO MEET CURRENT AND FUTURE EX-

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HAUST EMISSION REQUIREMENTS WITH SUCH ENGINES.

by A. G. BELL  
SHELL RES. LTD., THORNTON RES. CENTRE,  
CHESTER, ENGLAND  
Publ: HS-022 661, "FUEL ECONOMY OF THE GASOLINE  
ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS,"  
NEW YORK, 1977 P44-67  
1977; 11REFS  
Availability: IN HS-022 661

FERENCES IN VISCOSITY OF NORMAL GASOLINES  
WOULD NOT BE MUCH GREATER THAN 1%.

by B. D. CADDOCK  
SHELL RES. LTD., THORNTON RES. CENTRE,  
CHESTER, ENGLAND  
Publ: HS-022 661, "FUEL ECONOMY OF THE GASOLINE  
ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS,"  
NEW YORK, 1977 P68-76  
1977; 4REFS  
Availability: IN HS-022 661

HS-022 664

### THE EFFECT OF THE PHYSICAL PROPERTIES OF GASOLINE ON FUEL ECONOMY

THEORETICAL CONSIDERATIONS INDICATE THAT CHANGES IN THE FOLLOWING PHYSICAL PROPERTIES WOULD BE EXPECTED TO INFLUENCE FUEL ECONOMY IN APPROPRIATE CIRCUMSTANCES: NET VOLUMETRIC HEATING VALUE, SPECIFIC GRAVITY, FUEL VOLATILITY, AND FUEL VISCOSITY. THE THEORETICAL DEPENDENCE OF FUEL ECONOMY ON BOTH HEATING VALUE AND SPECIFIC GRAVITY CAN BE DESCRIBED BY THE EQUATION  $MPG = K(MD)^C$ , WHERE MPG IS THE FUEL ECONOMY (IN MILES PER GALLON) OF A FULLY WARMED-UP ENGINE RUNNING AT CONSTANT SPEED, K IS A CONSTANT SPECIFIC TO A GIVEN CAR AND SPEED, M AND C ARE CONSTANTS FOR THE PARTICULAR GROUP OF CARS AND GASOLINES CONCERNED (I.E. U.S. CARS AND FUELS), AND D IS THE SPECIFIC GRAVITY OF THE FUEL. THIS LINEAR DEPENDENCE OF FUEL ECONOMY ON SPECIFIC GRAVITY IS CLOSELY ASSOCIATED WITH THE EFFECT OF THE VOLUMETRIC HEATING VALUE, AS SHOWN BY THE EQUATION  $MPG = KQV^N$ , WHERE K IS A CONSTANT, QV IS THE VOLUMETRIC HEATING VALUE OF THE FUEL, AND N IS THE THERMAL EFFICIENCY. BENCH ENGINE TESTS HAVE DEMONSTRATED THAT AN ECONOMY BONUS OF FROM 7% TO 10% CAN BE ACHIEVED BY AN INCREASE IN SPECIFIC GRAVITY OF 0.1 UNDER CONSTANT LOAD CONDITIONS. UNDER LONG-TRIP ROAD CONDITIONS BENEFITS OF FROM 7.5% TO 8% WERE OBSERVED IN PRACTICE WITH AN INCREASE IN SPECIFIC GRAVITY OF 0.1. WITH RESPECT TO FUEL VOLATILITY, STUDIES SHOW THAT THERE IS A CONFLICT IN THE REQUIREMENTS FOR BETTER ECONOMY UNDER SHORT-TRIP AND LONG-TRIP CONDITIONS. FOR SHORT TRIPS IN COLD WEATHER A HIGH-VOLATILITY FUEL IS BENEFICIAL FOR CARS WITH MANUAL CHOKES, PROVIDED THE DRIVER TAKES ADVANTAGE OF THE BETTER VOLATILITY TO RELEASE THE CHOKE EARLIER. FOR LONG TRIPS THE BEST ECONOMY IS ALWAYS RETURNED BY THE HIGHER GRAVITY FUEL. WITH RESPECT TO FUEL VISCOSITY, EXPERIMENTAL WORK HAS SHOWN THAT A GAIN IN ECONOMY CAN BE ACHIEVED BY THICKENING GASOLINES WITH ADDITIVES TO INDUCE GROSS INCREASES IN VISCOSITY BUT THAT THIS GAIN IS ONLY ACHIEVED BY CAUSING THE ENGINE TO OPERATE UNDER LEANER CONDITIONS THAN THE DESIGNER INTENDED. ALSO, THE MAXIMUM DIFFERENCE EXPECTED FROM THE DIFFERENCES

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### THE EFFECT OF GASOLINE ADDITIVES ON FUEL ECONOMY

THE CONTRIBUTION OF THE FOLLOWING MAJOR CLASSES OF ADDITIVES TO FUEL ECONOMY ARE CONSIDERED SEPARATELY: ANTIKNOCK ADDITIVES, ANTIOXIDANTS, ANTI-ICING ADDITIVES, IGNITION CONTROL ADDITIVES, AND CARBURETOR AND INLET SYSTEM CLEANLINESS ADDITIVES. ANTIKNOCK ADDITIVES CONTRIBUTE TO IMPROVED FUEL CONSUMPTION PROVIDED THAT ENGINE REQUIREMENT AND FUEL OCTANE LEVEL ARE MATCHED. IN AN ENGINE WHICH IS KNOCKFREE ON A GIVEN FUEL, THE ADDITION OF AN ANTIKNOCK AGENT WOULD CONFER NO BENEFIT. AT TODAY'S COMPRESSION RATIOS THE CONTRIBUTION OF AN ANTIKNOCK ADDITIVE IS ABOUT 1% IMPROVEMENT IN FUEL ECONOMY FOR EACH OCTANE NUMBER INCREASE. THE CONTRIBUTION OF ANTI-OXIDANTS TO FUEL ECONOMY CAN BE SEEN AS ONE WHICH PERMITS THE INCLUSION OF LESS STABLE BUT HIGHER OCTANE COMPONENTS IN ENGINE GASOLINE. THE ADDITIVE ROLE IS A LIMITED ONE, HOWEVER, AS GASOLINES MADE BY CATALYTIC REFORMING SELDOM NEED THE ADDITION OF ANTI-OXIDANTS. IT IS THEREFORE NOT POSSIBLE TO QUANTIFY THE CONTRIBUTION TO FUEL ECONOMY ARISING FROM THE USE OF ANTI-OXIDANTS. THE DRIVER OF A CAR WHICH IS SENSITIVE TO CARBURETOR ICING AND WHO LIVES IN AN AREA WITH THE RIGHT CLIMATIC CONDITIONS WILL UNDOUBTEDLY BENEFIT FROM THE USE OF ANTI-ICING ADDITIVES. THE EFFECTS OF ANTI-ICING ADDITIVES ON FUEL ECONOMY ALTHOUGH DIRECTIONALLY FAVORABLE ARE PROBABLY NOT SIGNIFICANT IN MARKET VOLUME TERMS. WITH RESPECT TO IGNITION CONTROL ADDITIVES (PHOSPHORUS-CONTAINING FUEL ADDITIVES), IT IS POSSIBLE TO DEMONSTRATE THAT SPARK-PLUG MISFIRE (RESULTING FROM SPARK PLUG FOULING) INCREASES FUEL CONSUMPTION AND THAT THE USE OF PHOSPHORUS ADDITIVES CAN RESTORE FUEL CONSUMPTION TO THAT ACHIEVED WITH CLEAN PLUGS. WHILE PHOSPHORUS ADDITIVES HAD A MINOR ROLE TO PLAY WITH RESPECT TO FUEL CONSUMPTION IN PAST YEARS, THE NEED FOR SUCH ADDITIVES, IN GENERAL, IS DECREASING AND SUCH ADDITIVES WILL SLOWLY DISAPPEAR FROM GASOLINE. FINALLY, THE MOST RECENT MAJOR DEVELOPMENT IN THE GASOLINE ADDITIVE FIELD HAS BEEN THE EMERGENCE OF A SECOND AND MUCH MORE EFFECTIVE GENERATION OF INLET SYSTEM CLEANLINESS ADDITIVES. THESE ADDITIVES HAVE A SIGNIFICANT ROLE TO PLAY WITH RESPECT TO BETTER

FUEL ECONOMY. AN EFFECTIVE ADDITIVE CAN LARGELY PREVENT DEPOSIT FORMATION IN THE CARBURETOR AND INLET SYSTEM AND THUS PRESERVE THE AIR/FUEL RATIO SETTINGS INTENDED BY THE ENGINE MANUFACTURER.

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### THE EFFECT OF MIXTURE PREPARATION ON FUEL ECONOMY

THE FOLLOWING ASPECTS OF MIXTURE PREPARATION ON FUEL ECONOMY ARE CONSIDERED SEPARATELY: MIXTURE QUALITY IN CURRENT CARBURETTED ENGINES, MIXTURE MALDISTRIBUTION BETWEEN CYLINDERS, COLD STARTING AND THE USE OF THE CHOKE, ENGINE POWER AND ITS IMPACT ON FUEL ECONOMY DURING ROAD SERVICE, MIXTURE QUALITY AND FUEL CONSUMPTION AT PART LOAD, MIXTURE QUALITY AND FUEL CONSUMPTION AT FULL THROTTLE, ENGINE OPERATION WITH WEAK MIXTURES, PRACTICAL SYSTEMS FOR IMPROVED MIXTURE PREPARATION, AND FUEL INJECTION SYSTEMS. THE EFFECT OF MIXTURE QUALITY ON FUEL ECONOMY IS SIGNIFICANT AND INCREASES IN IMPORTANCE THE WEAKER THE MIXTURE STRENGTH BECOMES. IT IS OF PARTICULAR IMPORTANCE FOR SMOOTH ENGINE OPERATION UNDER TRANSIENT CONDITIONS. IN MULTICYLINDER ENGINES, GOOD MIXTURE QUALITY ELIMINATES INTERCYLINDER FUEL MALDISTRIBUTION AND ALLOWS THE CARBURETOR TO BE TUNED TO THE MAXIMUM ECONOMY MIXTURE STRENGTH. UNDER COLD RUNNING CONDITIONS GOOD MIXTURE QUALITY ALLOWS MINIMAL USE OF THE CHOKE, THEREBY REDUCING SHORT-TRIP FUEL CONSUMPTION. WITH A PERFECT MIXTURE PREPARATION SYSTEM, AT LEAST PART OF THE ENGINE POWER COULD BE CONTROLLED ON MIXTURE STRENGTH ALONE; THIS WOULD SIGNIFICANTLY IMPROVE PART-LOAD FUEL ECONOMY. FINALLY, MANY DEVICES EXIST FOR IMPROVING MIXTURE QUALITY; THEY IMPROVE FUEL ECONOMY, HOWEVER, ONLY IF THE MIXTURE STRENGTH AND SPARK TIMING ARE ADJUSTED CORRECTLY TO EXPLOIT THE BENEFITS THAT THEY CONFER.

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CHESTER, ENGLAND  
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### THE EFFECT OF VEHICLE MAINTENANCE ON FUEL ECONOMY

RESULTS AND CONCLUSIONS REACHED FROM VARIOUS EXPERIMENTAL STUDIES (MOST NOTABLY THOSE BY SHELL RESEARCH LTD. AND THE CHAMPION SPARK PLUG CO.) DESIGNED TO EVALUATE SOME OF THE MORE OBVIOUS INFLUENCES OF VEHICLE DEFECTS (OR MALADJUSTMENTS) ON VEHICLE FUEL ECONOMY ARE REPORTED. ENGINE TUNING FACTORS HAVE A MAJOR INFLUENCE ON FUEL ECONOMY, AND CORRECT MIXTURE STRENGTH SETTINGS AND CONFORMITY WITH AUTO MANUFACTURERS' IGNITION SPECIFICATIONS ARE PARTICULARLY IMPORTANT. THE MAJOR MAINTENANCE FACTORS AFFECTING FUEL ECONOMY ARE AS FOLLOWS, IN ORDER OF DECREASING IMPORTANCE: IDLING MIXTURE STRENGTH AND ENGINE IDLING SPEED, BASIC IGNITION TIMING/DWELL ANGLE, VACUUMATIC IGNITION ADVANCE, CENTRIFUGAL IGNITION ADVANCE, AND SPARK PLUG CONDITION. THE FULL BENEFITS WITH RESPECT TO FUEL ECONOMY CAN ONLY BE ACHIEVED BY SYSTEMATIC AND PRECISE DIAGNOSIS OF ENGINE MALFUNCTIONS FOLLOWED BY CORRECTIVE ADJUSTMENTS. FOR THIS PURPOSE MODERN DIAGNOSTIC FACILITIES ARE REQUIRED, AND BOTH CARBON MONOXIDE AND HYDROCARBON METERS ARE ESSENTIAL, USED IN CONJUNCTION WITH ACCURATE INSTRUMENTATION FOR SETTING IGNITION TIMING. EACH VEHICLE EXHIBITS ITS OWN UNPREDICTABLE PATTERN OF ENGINE FAULTS AND MALFUNCTIONS; SOME OF THE COMMON FAULTS ARE AS FOLLOWS, IN ORDER OF DECREASING FREQUENCY: IDLE MIXTURE SETTING, BASIC IGNITION TIMING, DWELL ANGLE, VALVE ADJUSTMENT (TAPPETS), AND SPARK PLUG REPLACEMENT. THE CORRECTION OF EACH OF THESE FAULTS DOES NOT NECESSARILY GIVE THE SAME FUEL ECONOMY BENEFIT. COMPREHENSIVE INFORMATION ON THE FREQUENCY OF OCCURRENCE OF EACH MAINTENANCE ITEM IS SLOWLY BEING BUILT UP, BUT SIMILAR INFORMATION ON THE SEVERITY OF THE FAULTS IS LACKING. THE MAGNITUDE OF FUEL CONSUMPTION WILL, OF COURSE, IN EACH PARTICULAR CASE DEPEND ON THE MECHANICAL STATE OF THE VEHICLE. SOME VEHICLES WITH MANY DEFECTS MAY SHOW FUEL ECONOMY BENEFITS AS LARGE AS 20% AFTER THE PROPER CORRECTIONS HAVE BEEN MADE TO PROVIDE SATISFACTORY FUNCTIONAL PERFORMANCE. HOWEVER, THE PUBLISHED WORK SUGGESTS THAT AN IMPROVEMENT OF UP TO 6% WOULD BE MORE TYPICAL. FINALLY, WITH EVOLVING CAR DESIGN, NEW EQUIPMENT, PARTICULARLY FOR EMISSION CONTROL, WILL POSE NEW PROBLEMS WITH RESPECT TO VEHICLE MAINTENANCE.

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HS-022 668

## THE EFFECT OF EMISSION CONTROLS ON FUEL ECONOMY

THE EFFECT OF EMISSION CONTROLS ON FUEL ECONOMY IS DISCUSSED IN TERMS OF HISTORICAL SURVEYS OF U.S. VEHICLE FUEL ECONOMY (ENVIRONMENTAL PROTECTION AGENCY (EPA) PUBLICATIONS FOR MODEL YEARS 1974, 1975, AND 1976 AND SURVEILLANCE DATA BACK TO 1957), AND IN TERMS OF THE MEANS USED FOR CONTROLLING THE DIFFERENT EXHAUST POLLUTANTS AT VARYING LEVELS OF SEVERITY, AND THE EXHAUST EMISSION CONTROL SYSTEMS THAT HAVE BEEN USED IN RECENT YEARS. SOME GENERAL AND PRACTICAL RELATIONSHIPS REGARDING EMISSION CONTROLS AND FUEL ECONOMY ARE PRESENTED. FIRST, THERE IS A STRONG INVERSE RELATIONSHIP BETWEEN FUEL ECONOMY AND EMISSION LEVEL FOR A GIVEN TECHNOLOGY AND PERFORMANCE LEVEL, AND THIS BECOMES MORE PRONOUNCED AS THE SEVERITY OF THE EMISSION CONTROL IS INCREASED, PARTICULARLY WITH RESPECT TO NOX (NITROGEN OXIDES) EMISSIONS. SECOND, THERE IS A STRONG POSITIVE RELATIONSHIP BETWEEN FUEL ECONOMY AND THE TECHNOLOGICAL COMPLEXITY OF THE ENGINE AND ITS CONTROL SYSTEM FOR A GIVEN EMISSION LEVEL AND PERFORMANCE LEVEL, AND THIS IS ALL THE MORE PRONOUNCED AS THE INDUSTRY MAKES FURTHER IMPROVEMENTS. HOWEVER, SUCH TECHNOLOGICAL IMPROVEMENT WILL COST MONEY UNLESS A DOUBLE BREAKTHROUGH TAKES PLACE. AND, THIRD, THERE IS A STRONG TRADE-OFF RELATIONSHIP BETWEEN FUEL ECONOMY AND PERFORMANCE FOR A GIVEN EMISSION LEVEL AND TECHNOLOGY, VERY LITTLE DIFFERENT FROM THE TRADITIONAL ONE THAT HAS BEEN KNOWN FOR MANY YEARS. IT IS ALSO CONCLUDED THAT THERE IS NO GENERAL THERMODYNAMIC LINK BETWEEN ENGINE EFFICIENCY AND EXHAUST EMISSIONS, ALTHOUGH BECAUSE AN ENGINE IS SUBJECT TO THE LIMITATIONS OF, FOR EXAMPLE, KINETICS AND SURFACE CHEMISTRY, IT IS NOT CLEAR HOW CLOSE IT WILL BE POSSIBLE TO COME TO THE THERMODYNAMIC IDEAL. FOR EUROPE IN THE NEAR FUTURE, IT IS CONCLUDED THAT THE FOLLOWING TWO EFFECTS WILL BE NOTICEABLE: SOME LOSS OF OVERALL EFFICIENCY AS AN INDIRECT CONSEQUENCE OF THE DECREASING CONTENT OF LEAD IN GASOLINE (A LOSS AT THE REFINERY IF GASOLINE OCTANE QUALITY IS HELD CONSTANT, A LOSS IN THE CAR IF THE QUALITY FALLS), AND A SMALL GAIN IN FUEL ECONOMY BECAUSE OF THE IMPOSITION OF RELATIVELY MILD CO (CARBON MONOXIDE) AND HC (HYDROCARBONS) CONTROLS, AS LONG AS NOX CONTROL STAYS AT ITS CURRENT LEVEL. FOR EUROPE IN THE FURTHER FUTURE, THE INTRODUCTION OF TIGHTER EMISSION CONTROLS MAY CAUSE A DETERIORATION IN FUEL ECONOMY BUT THIS SHOULD BE LESSENERED BY DEVELOPMENT OF APPROPRIATE TECHNOLOGY; THE INTRODUCTION OF EXTREMELY STRINGENT EMISSION CONTROLS MIGHT RESULT IN THE USE OF A RADICALLY DIFF-

FERENT ENGINE TO MEET THESE STANDARDS AND TO PRESERVE GOOD FUEL ECONOMY.

by D. R. BLACKMORE

SHELL RES. LTD., THORNTON RES. CENTRE,  
CHESTER, ENGLAND

Publ: HS-022 661, "FUEL ECONOMY OF THE GASOLINE ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS,"  
NEW YORK, 1977 P133-56  
1977; 22REFS

Availability: IN HS-022 661

HS-022 669

## THE MEASUREMENT OF FUEL ECONOMY

THE VARIOUS TYPES OF TESTS AND ASSOCIATED EQUIPMENT USED TO MEASURE FUEL CONSUMPTION BY VEHICLES INCLUDE THE FOLLOWING: UNCONTROLLED ROAD TESTS, CONTROLLED ROAD TESTS, CYCLE TESTS ON THE ROAD (INCLUDING CONSTANT-SPEED TESTS), CYCLE TESTS ON CHASSIS DYNAMOMETER (INCLUDING CONSTANT-SPEED TESTS), AND BENCH ENGINE TESTS. IN SUMMARY, FOR UNCONTROLLED ROAD TESTS (VOLUMETRIC AND GRAVIMETRIC (SINGLE WEIGHINGS BEFORE AND AFTER THE TEST) METHODS OF FUEL FLOW MEASUREMENT), THE FOLLOWING RATINGS ARE GIVEN: PRACTICAL RELEVANCE, VERY HIGH; REPEATABILITY, VERY POOR; REPRODUCIBILITY, VERY POOR; EQUIPMENT COST, VERY LOW; AND TOTAL COST, VERY HIGH. FOR CONTROLLED ROAD TESTS (VOLUMETRIC AND GRAVIMETRIC (SINGLE WEIGHINGS BEFORE AND AFTER THE TEST) METHODS), THE RATINGS ARE AS FOLLOWS: PRACTICAL RELEVANCE, HIGH; REPEATABILITY, FAIR; REPRODUCIBILITY, POOR; EQUIPMENT COST, LOW; AND TOTAL COST, VERY HIGH. FOR ROAD CYCLE TESTS (VOLUMETRIC AND GRAVIMETRIC (SINGLE WEIGHINGS BEFORE AND AFTER THE TEST) METHODS), THE RATINGS ARE AS FOLLOWS: PRACTICAL RELEVANCE, HIGH; REPEATABILITY, GOOD; REPRODUCIBILITY, FAIR; EQUIPMENT COST, LOW; AND TOTAL COST, MEDIUM. FOR CHASSIS DYNAMOMETER CYCLE TESTS (VOLUMETRIC, GRAVIMETRIC (SINGLE WEIGHINGS AND CONTINUOUS MEASUREMENT THROUGHOUT THE TEST), AND CARBON BALANCE BY EXHAUST ANALYSIS METHODS), THE RATINGS ARE AS FOLLOWS: PRACTICAL RELEVANCE, HIGH; REPEATABILITY, GOOD; REPRODUCIBILITY, FAIR; EQUIPMENT COST, HIGH; AND TOTAL COST, HIGH. FINALLY, FOR BENCH ENGINE TESTS (VOLUMETRIC, GRAVIMETRIC (SINGLE WEIGHINGS AND CONTINUOUS MEASUREMENT THROUGHOUT THE TEST), AND CARBON BALANCE BY EXHAUST ANALYSIS METHODS), THE FOLLOWING RATINGS ARE GIVEN: PRACTICAL RELEVANCE, LOW; REPEATABILITY, GOOD; REPRODUCIBILITY, FAIR; EQUIPMENT COST, HIGH; AND TOTAL COST, HIGH. IT IS EVIDENT THAT IT IS NOT EASY TO CHOOSE ONE METHOD WITH UNIQUE ADVANTAGES. THERE IS A CLEAR TREND TOWARDS THE ADOPTION OF CHASSIS DYNAMOMETER TESTS, THEIR POTENTIAL ADVANTAGES BEING GOOD PRECISION AND CONTROL, WHICH CAN ONLY BE REALIZED BY THE DEVELOPMENT AND ADOPTION OF PURPOSE-BUILT,

HIGH-QUALITY CHASSIS DYNAMOMETERS AND THE USE OF REPRESENTATIVE CYCLES.

by R. BURT  
SHELL RES. LTD., THORNTON RES. CENTRE,  
CHESTER, ENGLAND  
Publ: HS-022 661, "FUEL ECONOMY OF THE GASOLINE  
ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS,"  
NEW YORK, 1977 P157-93  
1977; 21REFS  
Availability: IN HS-022 661

HS-022 670

### **THE EFFECT OF CRANKCASE LUBRICANTS ON FUEL ECONOMY**

IT SEEMS FEASIBLE THAT MEASURES TAKEN TO REDUCE INTERNAL FRICTION IN GASOLINE (AND DIESEL) ENGINES BY MODIFYING THE CRANKCASE LUBRICANT COULD RESULT IN FUEL ECONOMY IMPROVEMENTS. SUCH IMPROVEMENTS COULD BE EFFECTED BY THE REDUCTION OF THE VISCOSITY OF THE LUBRICANT BASE FLUID OR THE INCORPORATION OF FRICTION-REDUCING ADDITIVES; THE USE OF VISCOSITY INDEX (VI) IMPROVERS THAT SUFFER LARGE TEMPORARY SHEAR LOSSES COULD ALSO EFFECT FUEL ECONOMY IMPROVEMENTS. FUEL ECONOMY BENEFITS WOULD BE GREATEST UNDER COLD-START, SHORT-TRIP RUNNING CONDITIONS. UNDER THESE CIRCUMSTANCES BENEFITS OF UP TO 10% APPEAR POSSIBLE BY, FOR EXAMPLE, REPLACING AN SAE 30 GRADE OIL BY ITS MULTIGRADE ANALOG, AN SAE 10W/30 OIL. CAUTION MUST BE EXERCISED SO THAT STEPS TAKEN TO IMPROVE FUEL ECONOMY BY MODIFYING THE LUBRICANT DO NOT HAVE A DELETERIOUS EFFECT ON OTHER OPERATING FACTORS SUCH AS OIL CONSUMPTION, ENGINE CLEANLINESS, OR WEAR PROTECTION.

by B. BULL; A. J. HUMPHRYS  
SHELL RES. LTD., THORNTON RES. CENTRE,  
CHESTER, ENGLAND  
Publ: HS-022 661, "FUEL ECONOMY OF THE GASOLINE  
ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS,"  
NEW YORK, 1977 P194-202  
1977; 13REFS  
Availability: IN HS-022 661

HS-022 671

### **THE EFFECT OF TRANSMISSION LUBRICANTS ON FUEL ECONOMY**

SELECTED COMBINATIONS OF ENGINE OIL AND POWER TRAIN LUBRICANT CAN RESULT IN AN OVERALL IMPROVEMENT IN FUEL ECONOMY IN THE ORDER OF 0.9%-5.0% IN COLD-START, COLD-WEATHER SERVICE FOR TRIPS OF ONE TO EIGHT MILES. LUBRICANT-RELATED FUEL ECONOMY IMPROVEMENTS DIMINISH WITH INCREASING TRIP LENGTH FROM ONE TO EIGHT MILES. FUEL ECONOMY IMPROVEMENTS AFTER THE FIRST EIGHT MILES, WHILE SMALL, ARE NOT NEGLIGIBLE (UP TO 3%). THESE FIGURES APPLY TO BOTH FULL-SIZED AND COMPACT AMERICAN CARS; THERE ARE VERY FEW EQUIVALENT DATA AVAILABLE ON EUROPEAN CARS. AMBIENT TEMPERATURE CAN SIGNIFICANTLY

AFFECT THE APPARENT FUEL ECONOMY IMPROVEMENT RESULTING FROM SELECTED LUBRICATION. THERE IS SOME EVIDENCE TO SUGGEST THAT THE EFFECT OF LUBRICANT VISCOSITY ON FUEL ECONOMY IS GREATER FOR ENGINE OILS THAN FOR REAR-AXLE LUBRICANTS WHICH IN TURN IS GREATER THAN FOR AUTOMATIC TRANSMISSION FLUIDS. ONLY LUBRICANTS OF A LIMITED VISCOSITY RANGE HAVE BEEN TESTED SO FAR; THIS COULD BE EXTENDED PROVIDED THERE IS A SUITABLE CHOICE OF ADDITIVES FOR MAINTAINING LUBRICANT PERFORMANCE.

by E. L. PADMORE  
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CHESTER, ENGLAND  
Publ: HS-022 661, "FUEL ECONOMY OF THE GASOLINE  
ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS,"  
NEW YORK, 1977 P203-20  
1977; 6REFS  
Availability: IN HS-022 661

HS-022 672

### **MILEAGE MARATHONS [FUEL ECONOMY]**

THE THEORY BEHIND THE SHELL MILEAGE MARATHONS IS DISCUSSED, AND THE VEHICLE AND DRIVING TECHNIQUE USED FOR THE WINNING ENTRY IN THE 1976 THORNTON RESEARCH CENTRE (CHESTER, ENGLAND) MILEAGE MARATHON (SPECIAL CATEGORY) IS DESCRIBED. THE BASIS FOR THE MILEAGE MARATHONS, WHICH HAVE BEEN RUN AT THE SHELL LABORATORIES PERIODICALLY SINCE 1939, IS THE QUESTION OF HOW FAR CAN A MOTOR VEHICLE GO ON A QUANTITY OF FUEL IF SOME OR MOST OF THE CONSTRAINTS ON ITS CONSTRUCTION AND USE ARE REMOVED. MARATHONING IS DOMINATED BY TWO CONSIDERATIONS. FIRST, THE POWER NEEDED TO PROPEL THE VEHICLE MUST BE KEPT TO AN ABSOLUTE MINIMUM. SECOND, THE ENGINE AND OPERATING CONDITIONS MUST BE CHOSEN SO THAT THE POWER REQUIREMENT IS MET WITH MINIMUM FUEL UTILIZATION. FOR THE 1976 SPECIAL CATEGORY OF MILEAGE MARATHON, A "SPECIAL" WAS DEFINED AS A VEHICLE WITH AT LEAST THREE WHEELS, EACH OF WHICH MUST SUPPORT AT LEAST 20% OF THE TOTAL WEIGHT OF THE VEHICLE PLUS DRIVER IN THE NORMAL DRIVING POSITION. THE POWER UNIT HAD TO BE A FOUR-STROKE GASOLINE ENGINE WITH NO RESTRICTION ON CAPACITY OR NUMBER OF CYLINDERS. ALSO, THE VEHICLE HAD TO HAVE AT LEAST ONE WHEEL BRAKING, AND ADJUSTABLE AIDS TO FORWARD MOTION WERE BANNED (VEHICLE ONLY POWERED BY ENERGY OBTAINED FROM GASOLINE CARRIED IN THE REGULATION GLASS FUEL TANK). THE RULES ALSO ALLOWED THE VEHICLE TO COAST WITH THE ENGINE SWITCHED OFF. THE FUEL CONSUMPTION BY THE WINNING VEHICLE WAS 1141 MILES/GALLON OR 0.248 L/100 KM. THE

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VALUE BROKE THE CHALLENGING 1000  
MILE/GALLON TARGET BY 14.1%.

by W. S. AFFLECK; G. B. TOFT  
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CHESTER, ENGLAND  
Publ: HS-022 661, "FUEL ECONOMY OF THE GASOLINE  
ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS,"  
NEW YORK, 1977 P221-37  
1977; 6REFS  
Availability: IN HS-022 661

HS-022 673

### **AN INTERVIEW SURVEY OF MOTORWAY DRIVER INFORMATION REQUIREMENTS AND SIGNAL UNDERSTANDING**

A HOME INTERVIEW SURVEY OF DRIVERS USING  
ROUTES M4 OR A4 BETWEEN SLOUGH AND LONDON,  
ENGLAND, WAS CARRIED OUT DURING 1973 TO OB-  
TAIN INFORMATION ON VARIOUS ASPECTS OF MO-  
TORWAY USE. DRIVERS WERE SELECTED AT RAN-  
DOM FROM DRIVING LICENSE RECORDS FROM THE  
COUNTY OF BERKS. (INCLUDING THE BOROUGH OF  
READING), AND 523 INTERVIEWS WERE SUCCESS-  
FULLY COMPLETED. THE RESULTS FROM THESE  
WERE WEIGHTED ACCORDING TO EACH RESPON-  
DENT'S FREQUENCY OF TRAVEL ON THESE  
STRETCHES OF ROAD, SO AS TO GIVE DATA  
REPRESENTATIVE OF ALL THE DRIVERS LIVING IN  
BERKSHIRE WHO USED THESE ROADS. THE DRIVERS  
WERE QUESTIONED ABOUT THEIR USE OF M4 AND  
A4, AND ABOUT FACTORS THEY THOUGHT WERE IM-  
PORTANT CONCERNING THEIR CHOICE OF ROUTE,  
SUCH AS BAD WEATHER, DELAYS AND HAZARDS.  
QUESTIONS WERE ALSO ASKED ABOUT THEIR  
REQUIREMENTS FOR TRAFFIC INFORMATION AND  
ABOUT METHODS OF PROVIDING IT. THE DRIVERS  
WERE THEN SHOWN DIAGRAMS OF STANDARD, AND  
NONSTANDARD, MOTORWAY MATRIX-SIGNALS TO  
TEST THEIR UNDERSTANDING OF THEM. ONE FIND-  
ING WAS THAT THE RED 'STOP' LIGHTS WERE  
POORLY UNDERSTOOD AND OFTEN TREATED ONLY  
AS HAZARD WARNINGS.

by CHARMIAN ANDREW  
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ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-LR-742; 1977; 30P 1REF  
Availability: CORPORATE AUTHOR

HS-022 674

### **MALE AND FEMALE CAR DRIVERS: DIFFERENCES OBSERVED IN ACCIDENTS**

IN AN IN-DEPTH STUDY MADE OF 2654 CAR DRIVERS  
INVOLVED IN 2036 ACCIDENTS OVER A FOUR-YEAR  
PERIOD, DIFFERENCES WERE INVESTIGATED IN THE  
DRIVER CHARACTERISTICS OF MEN AND WOMEN  
AND THE KIND OF HUMAN ERRORS THEY MADE.  
THE ANALYSIS SHOWED SOME SIGNIFICANT DIF-  
FERENCES BETWEEN THE SEXES IN THE TYPE OF  
ACCIDENTS AND THE SORT OF ERROR COMMITTED,  
BUT THERE WAS LITTLE DIFFERENCE IN THE PRO-  
PORTION OF MALES AND FEMALES WHO WERE RE-

GARDED AT FAULT, THE FIGURE BEING APPROXI-  
MATELY 60% OF DRIVERS FOR BOTH SEXES. THE  
FEMALE DRIVER TENDED TO MAKE ERRORS OF A  
PERCEPTUAL NATURE BY BECOMING DISTRACTED  
AND NOT SEEING HAZARDS; SHE WAS LESS EX-  
PERIENCED THAN THE MALE DRIVER AND FOUND  
THE RIGHT TURN MANEUVER DIFFICULT, ESPE-  
CIALY WHEN ENTERING A MAJOR ROAD. THE  
MALE DRIVER WAS MORE LIKELY TO BE IMPAIRED  
THROUGH ALCOHOL, TENDED TO DRIVE TOO FAST  
FOR THE CONDITIONS, AND MORE READILY TOOK  
RISKS.

by VALERIE J. STORIE  
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ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-LR-761; 1977; 29P 9REFS  
Availability: CORPORATE AUTHOR

HS-022 675

### **A REANALYSIS OF CALIFORNIA DRIVER VISION DATA: GENERAL FINDINGS**

DATA ON OVER 14,000 DRIVERS FROM THE 1967  
CALIFORNIA DRIVER VISION STUDY WERE RE-  
ANALYZED WITH A VIEW TO ESTABLISHING THEIR  
IMPLICATIONS FOR DRIVER VISION STANDARDS.  
FOR THE MAIN ANALYSIS THE SAMPLE WAS DI-  
VIDED INTO FOUR AGE GROUPINGS: UNDER 25, 25-39,  
40-54, AND OVER 54. NO DIRECT RELATIONSHIP WAS  
FOUND BETWEEN POOR VISUAL PERFORMANCE  
AND HIGH ACCIDENT RATES FOR YOUNG AND MID-  
DLE-AGED DRIVERS. FOR THE OVER 54 AGE GROUP,  
DYNAMIC AND STATIC VISUAL ACUITY TESTS  
SHOWED THE MOST CONSISTENT RELATIONSHIPS  
WITH ACCIDENT RATES, BUT FOR AN INDIVIDUAL  
DRIVER THEIR ACCIDENT PREDICTION VALUE  
REMAINED VERY LOW. A MORE DETAILED AGE  
ANALYSIS FAILED TO DEFINE MORE PRECISELY THE  
AGE AT WHICH THESE RELATIONSHIPS DEVELOP.  
NO EVIDENCE WAS FOUND TO SUPPORT THE USE OF  
TOTAL VISUAL FIELD AS A DRIVER SCREENING  
TEST. THE RESULTS FOR TWO TESTS OF NIGHT VI-  
SION (LOW-LIGHT RECOGNITION THRESHOLD AND  
GLARE RECOVERY) WERE REGARDED AS INCONCLU-  
SIVE FOR THE OVER 54 AGE GROUP. FOR THE SAME  
NOMINAL STANDARD OF BINOCULAR STATIC  
VISUAL ACUITY, THE ORTHO-RATER SCREENER WAS  
FOUND TO FAIL MARKEDLY FEWER DRIVERS THAN  
THE SNELLEN WALL CHART. THE IMPLICATIONS OF  
VARYING THE CUT-OFF SCORES FOR EACH TEST  
WERE INVESTIGATED, AND THE SUGGESTION MADE  
THAT PERCEPTUAL RATHER THAN SENSORY TESTS  
WITH GREATER ACCIDENT PREDICTIVE POWER  
WOULD BE NEEDED BEFORE ACCEPTABLE ALTER-  
NATIVE SCREENING METHODS COULD BE SPECIFIED  
FOR DRIVER LICENSING PURPOSES.

by B. L. HILLS; A. BURG  
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ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-LR-768; 1977; 45P 18REFS  
Availability: CORPORATE AUTHOR

## A STUDY OF ROAD ACCIDENTS IN SELECTED URBAN AREAS IN DEVELOPING COUNTRIES

AN ANALYSIS OF PERSONAL INJURY ACCIDENT RATES IS PRESENTED FOR ROADS IN SELECTED URBAN AREAS IN DEVELOPING COUNTRIES. FOR A NUMBER OF CITIES, THE DISTRIBUTION OF ACCIDENTS IS SHOWN BY TYPE OF ROAD, CLASS OF ROAD-USER, AND VEHICLE INVOLVED. IT WAS FOUND THAT IN THE CITIES STUDIED, THE ACCIDENT AND CASUALTY RATES (PER LICENSED VEHICLE) WERE ABOUT 60% GREATER THAN IN URBAN AREAS IN GREAT BRITAIN. THE FATALITY RATES WERE FOUND TO BE AT LEAST EIGHT TIMES GREATER THAN IN GREAT BRITAIN AND UP TO THIRTY TIMES GREATER THAN IN THE U.S. RELATIONSHIPS BETWEEN ACCIDENT RATES AND VEHICLE AND PEDESTRIAN FLOWS WERE DERIVED AND COMPARED WITH SIMILAR RELATIONSHIPS DERIVED IN GREAT BRITAIN. SOME OF THE SUGGESTED CAUSES OF HIGH ACCIDENT FATALITY RATES, PARTICULARLY OF PEDESTRIANS, INCLUDE POOR ROAD DESIGN OR LACK OF STREET FURNITURE (I.E. LIGHTING, GUARD RAILS), POOR VEHICLE MAINTENANCE, AND POOR ROAD-USER BEHAVIOR. OTHER POSSIBLE CAUSES INCLUDE THE USE OF POTENTIALLY UNSAFE VEHICLES (BICYCLES, MOPEDS, SCOOTER-RICKSHAWS), AND THE OVERCROWDING OF PUBLIC TRANSPORTATION (PEOPLE RIDING ON THE OUTSIDE OF BUSES).

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ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-LR-775; 1977; 24P 21REFS  
Availability: CORPORATE AUTHOR

HS-022 677

## ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING

ANTILOCKING BRAKES WERE COMPARED WITH LOAD SENSING VALVES FOR EFFECTIVENESS AGAINST JACKKNIFING. SOME 400 ARTICULATED VEHICLES WERE TESTED OVER FOUR YEARS, HALF OF THE NUMBER BEING FITTED WITH ANTILOCKING BRAKES ON THE DRIVE AXLES AND HALF HAVING LOAD SENSING VALVES. ALL VEHICLES WERE DRIVEN UNDER SIMILAR CONDITIONS OF NORMAL COMMERCIAL OPERATION. ANALYSIS WAS MADE OF 478 ROAD ACCIDENTS INVOLVING THESE VEHICLES AND CATEGORIES WERE ASSIGNED TO THE ACCIDENT CAUSES: JACKKNIFING (BRAKING AND POWER), TRAILER SWING, 'LOAD FELL OFF,' 'LOAD STUCK OUT,' 'LOAD SLID FORWARD,' 'VEHICLE CUT IN,' MECHANICAL FAILURE OF BRAKES OR OTHER COMPONENT, AND FAILURE TO STOP IN TIME. THE DRIVER AND OTHER FACTORS, AND OTHER VEHICLE OR ROAD USER, OCCUPIED SEPARATE CATEGORIES. JACKKNIFING ACCIDENTS WERE CATEGORIZED BY VEHICLE SIZE, LOAD CONDITION, AND BY ROAD SURFACE. ALTHOUGH THE NUMBERS OF ACCIDENTS ARE TOO SMALL TO BE SIGNIFICANT, THE VEHICLES

WITH ANTILOCKING BRAKES HAD FEWER JACKKNIFING ACCIDENTS THAN THOSE WITH LOAD SENSING VALVES. THERE WAS LITTLE DIFFERENCE, EITHER IN TOTAL NUMBER OR TYPE, BETWEEN THE ACCIDENTS OF THE VEHICLES WITH ANTILOCKING BRAKES AND THOSE OF THE LOAD SENSED VEHICLES.

by H. A. WILKINS  
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ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-SR-222; 1977; 14P 5REFS  
Availability: CORPORATE AUTHOR

HS-022 678

## THE ADHESIVE TESTING OF HIGH STRENGTH LAMINATES FOR STRUCTURAL DURABILITY

THE SUITABILITY OF URETHANE STRUCTURAL BONDING SYSTEMS HAS BEEN TESTED FOR SPECIAL LIGHTWEIGHT STEELS, ALUMINUM, HMC AND XMC POLYESTER LAMINATES, AND BOTH SOLID AND FOAM STRUCTURAL THERMOPLASTICS. THE HISTORY OF STRUCTURAL BONDING IN THE AUTOMOTIVE INDUSTRY IS OUTLINED. STRUCTURAL ADHESIVE MAKES IT POSSIBLE TO USE LIGHTWEIGHT PLASTICS AND METALS BY DISTRIBUTING STRUCTURAL STRESSES. THE MINIMUM REQUIREMENTS FOR AUTOMOTIVE STRUCTURAL BONDING INCLUDE HIGH SPEED CURING, SIMPLICITY IN MANUFACTURE (ADAPTABILITY TO AUTOMATION), LOW OR NO ENERGY CURING SYSTEM, LOW OR MODERATE COST, PROVEN PERFORMANCE, AND UNIFORM QUALITY. PASSENGER CAR DOORS ARE CONSIDERED LIKELY CANDIDATES FOR STRUCTURAL PLASTIC OR LIGHTWEIGHT METAL CONSTRUCTION, SINCE STRUCTURAL ADHESIVE SYSTEMS LEND THEMSELVES TO HIGH SPEED, HIGH VOLUME PRODUCTION. REDUCTION OF CORROSION BETWEEN DOOR PANELS WOULD BE AN ADVANTAGE OF THIS CONSTRUCTION. HOOD AND TRUNK DECKS, LIGHTWEIGHT FRAME COMPONENTS, AND BONDING SEATS TO AUTOMOBILE FLOORS ARE OTHER POSSIBLE APPLICATIONS. AMONG THE FACTORS IN TESTING AND SPECIFICATION OF ADHESIVE AND BONDING PROCESS ARE PHYSICAL PROPERTIES AS RELATED TO APPLICATION, ADHESION CHARACTERISTICS, RESISTANCE TO ENVIRONMENTAL DEGRADATION, AND DURABILITY TESTING. FLEX FATIGUE TESTING HAS BEEN DEMONSTRATED TO PROVE BOND STRENGTH DURABILITY FOR STRUCTURAL BONDING SYSTEMS. TESTING DATA ARE TABULATED TO DEMONSTRATE THE SUITABILITY OF URETHANE BONDING SYSTEMS FOR HIGH STRENGTH, STRUCTURAL AUTOMOTIVE APPLICATIONS.

by LAWRENCE R. CARAPELLOTTI  
GOODYEAR TIRE AND RUBBER CO.  
Rept. No. SAE-770234; 1977; 7P  
PRESENTED AT INTERNATIONAL AUTOMOTIVE  
ENGINEERING CONGRESS AND EXPOSITION,  
DETROIT, 28 FEB-4 MAR 1977.  
Availability: SAE



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**BEHAVIOUR OF DRIVERS ON YELLOW BAR PATTERNS - EXPERIMENT ON ALTON BY-PASS, HAMPSHIRE**

THE EFFECT OF THE YELLOW BAR PATTERN, A SPECIAL ROAD MARKING DESIGNED TO REDUCE VEHICLE SPEED IN THE PRESENCE OF ROAD HAZARDS, WAS STUDIED AT TWO SITES ON THE ALTON BY-PASS IN HAMPSHIRE, ENGLAND. THIRTY-TWO DRIVERS WERE TAKEN OVER THE SITES AND THEIR VEHICLE SPEEDS COMPARED WITH THOSE AT UN-MODIFIED SITES. A MATHEMATICAL MODEL WAS USED, WHICH INCLUDED SUCH SPEED INFLUENCING FACTORS AS THE PRESENCE OR ABSENCE OF THE YELLOW BAR PATTERN, THE DIFFERENCES IN TOPOGRAPHY BETWEEN THE TEST SITES AND THE CONTROL SITES, AND SUBJECT VARIABILITY (FASTER OR SLOWER DRIVERS). THERE WAS FOUND TO BE A DEFINITE INTERACTION AMONG THE PATTERN, THE SITE TOPOGRAPHY AND THE DRIVER, THE PATTERN ACTING AS A VISUAL WARNING OF AN APPROACHING HAZARD IN SOME CIRCUMSTANCES. THE EFFECT OF THE PATTERN ON THE DRIVER WAS INFLUENCED BY A PRIOR ENCOUNTER IF THE SECOND ENCOUNTER OCCURRED WITHIN A SHORT TIME AFTER THE FIRST.

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Rept. No. TRRL-SR-263; 1977; 18P 4REFS  
Availability: CORPORATE AUTHOR

HS-022 680

**THE COVERT RESPONSES OF DRIVERS TO TWO ROAD BASED ALERTING DEVICES**

A COMPARISON WAS MADE BETWEEN TWO DRIVER ALERTING DEVICES INSTALLED ON THE APPROACHES TO HAZARDOUS ROUNDABOUT SITES IN WILTS., ENGLAND. ONE OF THESE DEVICES KNOWN AS A RUMBLE AREA PRODUCES BOTH AN AUDITORY AND VISUAL SIGNAL, WHEREAS THE OTHER DEVICE, CONSISTING OF A GRID OF YELLOW BARS, PRODUCES ESSENTIALLY VISUAL CUES. THE COVERT RESPONSE OF 25 SUBJECTS WAS EXAMINED USING SUBJECTIVE ASSESSMENTS, AND IN THE CASE OF NINE SUBJECTS, HEART RATE RESPONSES IN ADDITION. RESULTS OF THE HEART RATE TESTS INDICATE THAT RUMBLE AREAS GENERALLY INCREASED LEVELS OF ALERTNESS ALTHOUGH THERE WAS NO SIGNIFICANT SUPPORT FOR THIS FROM THE SUBJECTIVE ASSESSMENT. YELLOW BARS DID NOT APPEAR TO HAVE A SIMILAR EFFECT. THE DEVICES DID NOT ALARM SUBJECTS AND ALTHOUGH BOTH TENDED TO SLIGHTLY INCREASE LEVELS OF DISTRACTION THE RESULTING LEVEL WAS STILL LOW.

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Rept. No. TRRL-SR-267; 1977; 32P 14REFS  
Availability: CORPORATE AUTHOR

HS-022 681

**THE EFFECT OF VEHICLE AND ROAD CHARACTERISTICS ON COMMERCIAL VEHICLE SPEEDS IN ETHIOPIA**

THE EFFECT OF VEHICLE POWER TO WEIGHT RATIOS WAS EVALUATED ON THE SPEEDS OF COMMERCIAL VEHICLES OPERATING IN DIFFERENT TYPES OF PAVED TERRAIN IN ETHIOPIA. THE SPEEDS OF MEDIUM AND HEAVY GOODS VEHICLES ARE SHOWN TO BE CONSIDERABLY INFLUENCED BY THE POWER TO WEIGHT RATIO OF THE VEHICLE IN ADDITION TO THE PHYSICAL CHARACTERISTICS OF THE ROAD, BUT THE SPEEDS OF BUSES ARE APPARENTLY INFLUENCED ONLY BY THE LATTER. THE EFFECTS OF VEHICLE CHARACTERISTICS ON SPEED THAT WERE SUCCESSFULLY IDENTIFIED HAVE BEEN USED TO MODIFY THE SPEED-ESTIMATING EQUATIONS IN THE RD. TRANSPORT INVESTMENT MODEL FOR DEVELOPING COUNTRIES.

by S. W. ABAYNAYAKA; G. MOROSIUK; H. HIDE  
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DEPARTMENT OF TRANSPORT, TRANSPORT AND  
ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-SR-271; 1977; 22P 6REFS  
Availability: CORPORATE AUTHOR

HS-022 682

**A STUDY OF MALE MOTORISTS' ATTITUDES TO SPEED RESTRICTIONS AND THEIR ENFORCEMENT**

A SURVEY WAS CONDUCTED OF MALE MOTORISTS' ATTITUDES TO AND KNOWLEDGE OF SPEED LIMITS AND THEIR ENFORCEMENT IN ORDER TO EXAMINE MOTORISTS' REASONS FOR BREAKING SPEED LIMITS. LACK OF KNOWLEDGE OF THE POSITIONING AND SIGNPOSTING OF LIMITS ARE CONTRIBUTORY FACTORS IN SPEED LIMIT CONTRAVENTION. ATTITUDES TOWARD SPEED LIMITS WERE FOUND TO BE AMBIVALENT, RESPONDENTS APPEARING TO BE IN FAVOR OF SPEED LIMITS IN PRINCIPLE, BUT DISAPPROVING OF SEVERAL EXISTING RESTRICTIONS. KNOWLEDGE OF THE MEANING OF 'DERESTRICTION SIGN' VARIED SIGNIFICANTLY ACCORDING TO SOCIAL CLASS. EXACT KNOWLEDGE OF THE PENALTY FOR SPEED LIMIT CONTRAVENTION WAS RELATIVELY RARE, THE TENDENCY BEING TO UNDERESTIMATE THE PENALTY. RESPONDENTS TENDED TO OVERESTIMATE THE RISK OF BEING CAUGHT SPEEDING BY THE POLICE. IT WAS CONCLUDED THAT MALE MOTORISTS ARE NOT GENERALLY CONVINCED OF A SIGNIFICANT RELATIONSHIP BETWEEN SPEED LIMIT CONTRAVENTION AND ACCIDENT CAUSALITY.

by RACHEL HOGG  
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DEPARTMENT OF TRANSPORT, TRANSPORT AND  
ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-SR-276; 1977; 40P 22REFS  
Availability: CORPORATE AUTHOR



## ROAD ACCIDENTS AS A CAUSE OF DEATH IN DEVELOPING COUNTRIES

USING PUBLISHED DATA, A COMPARISON WAS MADE IN FIFTEEN DEVELOPING COUNTRIES OF THE NUMBER OF DEATHS FROM ROAD ACCIDENTS AND THE DEATHS FROM SPECIFIC DISEASES NORMALLY ASSOCIATED WITH THE THIRD WORLD. IT WAS FOUND THAT ROAD ACCIDENTS ACCOUNTED FOR ALMOST 17% OF THE TOTAL NUMBER OF DEATHS STUDIED, A VALUE EXCEEDED ONLY BY DEATHS FROM ENTERITIS (AND OTHER DIARRHEAL DISEASES). THE TRENDS IN THE DEATH RATE IN FOUR COUNTRIES OVER THE PERIOD 1960-1972 WERE CALCULATED. IT WAS FOUND THAT WHILE THE RATES FOR INFECTIOUS, INTESTINAL, AND RESPIRATORY DISEASES DECREASED, THE DEATH RATE FOR ROAD ACCIDENTS INCREASED OVER THIS PERIOD. AN ANALYSIS OF THE MEDICAL RECORDS OF THE THREE MAJOR HOSPITALS IN NAIROBI, KENYA, SHOWED THAT THERE WERE MORE IN-PATIENTS RECEIVING TREATMENT FOR ROAD ACCIDENTS IN 1974 THAN FOR ALL BUT ONE OF THE GROUPS OF DISEASES THOUGHT TO BE OF CONCERN IN DEVELOPING COUNTRIES. IN TWO OF THE HOSPITALS STUDIED, THE TREATMENT OF ROAD ACCIDENT CASES ACCOUNTED FOR OVER 13,000 IN-PATIENT DAYS, OVER 5% OF THE TOTAL AVAILABLE. THE ECONOMIC COST OF ROAD ACCIDENT FATALITIES IS AUGMENTED BY THE FACT THAT A LARGE PROPORTION OF ACCIDENTS AFFECT YOUNG ADULT MALES. BETTER EDUCATION IN ROAD BEHAVIOR, MORE STRINGENT DRIVING TESTS, AND IMPROVED ENFORCEMENT OF TRAFFIC LAWS ARE RECOMMENDED TO REDUCE ACCIDENT FATALITY RATES.

by G. D. JACOBS; MARGUERITE N. BARDSLEY  
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DEPARTMENT OF TRANSPORT, TRANSPORT AND  
ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-SR-277; 1977; 22P 11REFS  
Availability: CORPORATE AUTHOR

HS-022 684

## SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT STUDY AMONGST CHILDREN

TWENTY-NINE CHILDREN AGED 10-11 AND OVER WERE GIVEN THE OPPORTUNITY OF WEARING BSI APPROVED SAFETY HELMETS WHILE TAKING PART IN A NATIONAL CYCLING PROFICIENCY SCHEME RE-TEST IN A SCHOOL PLAYGROUND. THEY WERE AFTERWARDS QUESTIONED ABOUT THE COMFORT OF THE HELMETS AND THE EFFECT, IF ANY, THAT WEARING THEM HAD ON THEIR CYCLING. MOST WOULD LIKE TO OWN A HELMET FOR CYCLING AND SAID THAT THEY WOULD WEAR IT FOR MOST ACTIVITIES ON THEIR BICYCLES. FEW CHILDREN FOUND THE HELMET UNCOMFORTABLE OR DIFFICULT TO PUT ON. MOST COMPLAINTS WERE ASSOCIATED WITH THE CHIN STRAP. SOME CHILDREN (12) CLAIMED THAT THE HELMET MADE LOOKING BEHIND MORE DIFFICULT; SIX WERE OBSERVED TO HAVE MORE DIFFICULTY IN STEERING WHILE LOOKING BEHIND WHEN WEARING THE HELMET

THAN THEY DID WHEN NOT WEARING IT. THESE DIFFICULTIES MIGHT BE OVERCOME IF THE CHILDREN HAD MORE TIME TO BECOME ACCUSTOMED TO WEARING THE HELMETS.

by MARIE BENNETT; C. S. DOWNING  
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DEPARTMENT OF TRANSPORT, TRANSPORT AND  
ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-SR-283; 1977; 23P 4REFS  
Availability: CORPORATE AUTHOR

HS-022 685

## 'AWARE,' AN IN-VEHICLE VISUAL COMMUNICATION SYSTEM FOR DRIVERS

A POSSIBLE METHOD IS DESCRIBED OF COMMUNICATING WITH DRIVERS USING A DASHBOARD-MOUNTED VISUAL DISPLAY. THE SYSTEM WOULD WARN OF ROAD CONDITIONS AHEAD AND GIVE INSTRUCTIONS OR ADVICE INCLUDING DIVERSIONARY AND NAVIGATIONAL INFORMATION. MESSAGES TO BE RELAYED TO DRIVERS WOULD BE SELECTED AT A CONTROL OFFICE, BASED ON INFORMATION ABOUT PREVAILING TRAFFIC CONDITIONS. THE MESSAGES WOULD BE SENT IN DIGITAL FORM VIA LAND-LINES FROM THE CONTROL OFFICE TO THE RELEVANT ROAD SITE WHERE BURIED INDUCTION LOOPS WOULD CONTINUOUSLY TRANSMIT THE MESSAGE. FOR MOTORISTS PASSING THESE LOOPS, THE DASHBOARD-MOUNTED DISPLAY UNITS WOULD INDICATE THE MESSAGE BY ILLUMINATING LEGENDS AND DIGITS. THE FRONT FACE OF THE DISPLAY UNIT COULD READILY BE CHANGED TO PROVIDE FOR OTHER LANGUAGES. SMALL-SCALE EXPERIMENTS HAVE SHOWN THAT DRIVERS CAN READILY ASSIMILATE INFORMATION BY THIS MEANS, GIVING CONFIDENCE THAT A FULL-SCALE COMMUNICATION SYSTEM AS DESCRIBED COULD BE IMPLEMENTED USING KNOWN TECHNOLOGY.

by C. J. LINES; A. R. HODGE  
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DEPARTMENT OF TRANSPORT, TRANSPORT AND  
ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-SR-286; 1977; 19P  
Availability: CORPORATE AUTHOR

HS-022 686

## THE DEVELOPMENT OF RUMBLE AREAS AS A DRIVER ALERTING DEVICE

AN AUDIBLE DRIVER ALERTING DEVICE WAS DEVELOPED, CONSISTING OF A SERIES OF AREAS OF COARSE TEXTURED SURFACING. THE SPECIFICATION FOR THE LENGTH AND SPACING OF THE AREAS WAS DEVELOPED BY SIMULATING IN THE LABORATORY THE EFFECTS OF DRIVING OVER VARIOUS PATTERNS USING A CAR SIMULATOR AND RECORDED ROAD NOISE. A PATTERN OF NOISE CONSISTING OF A REGULAR SERIES OF 500 MS PULSES SEPARATED BY 500 MS WAS JUDGED SUITABLE FOR ALERTING DRIVERS. THE NOISE INCREASE IN THE PULSES OVER AMBIENT LEVELS SHOULD BE AT LEAST 4DB(A). THIS PATTERN WAS JUDGED MORE

NOTICEABLE THAN ONE USED IN EARLIER STUDIES. IT WAS FOUND THAT A SURFACE OF 19 MM STONE IN EPOXY RESIN PRODUCED NOTICEABLE INCREASES IN NOISE (9DB(A)) IN CARS AND LIGHT COMMERCIAL VEHICLES AND WAS SUITABLE FOR PRODUCING A DURABLE RUMBLE AREA INSTALLATION. IN THE FINAL SIMULATOR EXPERIMENTS SUBJECTS WERE ASKED TO JUDGE THE VARIOUS NOISE PATTERNS USING A VARIETY OF RATING SCALES. THE SPECIFICATION FOR THE CONSTRUCTION OF THE HIGH NOISE SURFACES WAS OBTAINED BY TESTING A NUMBER OF DIFFERENT SURFACES ON THE LABORATORY'S TEST-TRACK.

by G. R. WATTS

DEPARTMENT OF THE ENVIRONMENT, ENGLAND;  
DEPARTMENT OF TRANSPORT, TRANSPORT AND  
ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-SR-291; 1977; 17P 6REFS  
Availability: CORPORATE AUTHOR

HS-022 687

#### NEW DESIGNS THROUGH VIBRATION WELDING

A NEW PLASTICS ASSEMBLY TECHNIQUE BASED ON FRICTION WELDING OVERCOMES MANY LIMITATIONS OF CONVENTIONAL WELDING PROCESSES SUCH AS PART SIZE, SHAPE, MATERIAL, AND SPEED OF OPERATION. THE TECHNIQUE PRODUCES STRONG, PRESSURE-TIGHT JOINTS. THE ABILITY OF VIBRATION WELDING TO HANDLE LARGER PARTS AND TO WELD INTERNAL DIVIDERS MAKES IT POSSIBLE TO DESIGN MULTIFUNCTIONAL PARTS, AND CONVERSELY TO PROVIDE COMPOSITE DESIGN WHEN PREFERABLE. VIBRATION WELDING IS COMPARED TO OTHER TECHNIQUES, SUCH AS ULTRASONIC, SPIN, OR HOT-PLATE WELDING. THE DESIGN CONSTRAINTS FOR VIBRATION WELDING ARE THOSE OF REQUIRED RELATIVE MOTION, JOINT DESIGN, ALIGNING AND FIXTURING FEATURES, AND TOLERANCES. THE EQUIPMENT FOR VIBRATION WELDING IS DESCRIBED. THE TECHNIQUE IS EXPECTED TO MAKE POSSIBLE DEVELOPMENT OF NEW PRODUCTS IN AUTOMOBILE DESIGN AND TO INCREASE THE USE OF PLASTICS AND RUBBER FOR WEIGHT REDUCTION, PRODUCT IMPROVEMENT, AND LOWER COST.

by JIM MENGASON

BRANSON SONIC POWER CO., EAGLE RD., DANBURY,  
CONN. 06810  
Rept. No. SAE-770235; 1977; 12P 5REFS  
PRESENTED AT INTERNATIONAL AUTOMOTIVE  
ENGINEERING CONGRESS AND EXPOSITION,  
DETROIT, 28 FEB-4 MAR 1977.  
Availability: SAE

HS-022 688

#### A CONTENT ANALYSIS OF FIVE BOOKS ON DRIVING

AN ANALYSIS WAS MADE OF ITEMS OF INSTRUCTION GIVEN IN FIVE POPULAR BOOKS ON DRIVING, IN RELATION TO BASIC MANEUVERS RELEVANT TO LEARNER DRIVERS. CONFLICTING ADVICE WAS VERY RARE, THOUGH THE EXCLUSION OF ITEMS OF

ADVICE IN THE SHORTER BOOKS COULD POSSIBLY MISLEAD READERS. BOOKS SEEMED TO AGREE IN THE EMPHASIS GIVEN TO PARTICULAR MANEUVERS, WHEN THE NUMBERS OF ITEMS OF INSTRUCTION FOR EACH WERE COMPARED. THE POSSIBILITY OF GRADED INSTRUCTION IS CONSIDERED, WITH INSTRUCTION AND LEARNER'S OBJECTIVES VARIED ACCORDING TO HIS LEVEL OF SKILL. THERE IS A NEED FOR ASSESSING PRIORITIES. AN ALTERNATIVE APPROACH IS TO TEACH KEY PRINCIPLES RATHER THAN GIVING DETAILED INSTRUCTION. THE ITEMS OF INSTRUCTION SHOULD NOT BE CONSIDERED A SUBSTITUTE FOR PRACTICAL TRAINING BUT COULD BE HELPFUL AS AN AIDE-MEMOIRE AFTER INSTRUCTION. CHECKLISTS COULD HELP INSTRUCTORS AVOID OMITTING ESSENTIAL INFORMATION AND AS RECORDS OF INSTRUCTION COVERED.

by D. SHEPPARD; T. E. WINTER

DEPARTMENT OF THE ENVIRONMENT, ENGLAND;  
DEPARTMENT OF TRANSPORT, TRANSPORT AND  
ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-SR-294; 1977; 22P 13REFS  
Availability: CORPORATE AUTHOR

HS-022 689

#### RECOGNITION DISTANCES OF VEHICLE REAR MARKINGS AT NIGHT

THE DISTANCE AT WHICH A VEHICLE REAR MARKING OF THE 'CHEVRON' TYPE COULD BE RECOGNIZED ON AN UNLIT ROAD AT NIGHT WAS MEASURED. IT WAS FOUND THAT ON A CLEAR NIGHT, WITH CORRECTLY AIMED HEADLIGHTS, THE MARKING WAS RECOGNIZED AT A SLIGHTLY GREATER DISTANCE WHEN USING ANGLO-AMERICAN DIPPED HEADLIGHTS THAN WHEN EUROPEAN DIPPED HEADLIGHTS WERE USED. WHEN GLARE FROM OPPOSING HEADLIGHTS WAS ENCOUNTERED THERE WAS AN AVERAGE REDUCTION OF ABOUT 17% IN RECOGNITION DISTANCE OVER THAT WITHOUT GLARE. THE DEGREE OF REDUCTION IN RECOGNITION DISTANCE DUE TO OPPOSING GLARE INCREASED WITH THE AGE OF THE OBSERVER. VARYING THE MOUNTING HEIGHT OF THE MARKING WITHIN THE LIMITS PERMITTED BY LAW HAD NO EFFECT ON RECOGNITION DISTANCE. A REAR MARKING INCORPORATING A SPECIAL "HIGH INTENSITY" RETROREFLECTIVE MATERIAL WAS RECOGNIZED AT A DISTANCE APPROXIMATELY 20% GREATER THAN WAS THE STANDARD REAR MARKING, UNDER CONDITIONS OF OPPOSING GLARE. WHEN NO OPPOSING GLARE WAS PRESENT THE "HIGH-INTENSITY" MARKINGS HAD LITTLE ADVANTAGE OVER STANDARD MARKINGS. THE RECOGNITION DISTANCES OF THE ORDER OF 300 METERS OBTAINED IN THESE TESTS WERE ACHIEVED UNDER ALMOST IDEAL CONDITIONS OF TEST AND ARE PROBABLY IN EXCESS OF THOSE THAT WOULD BE ACHIEVED UNDER NORMAL CONDITIONS OF NIGHT DRIVING.

by J. A. REID

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DEPARTMENT OF TRANSPORT, TRANSPORT AND  
ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND  
Rept. No. TRRL-SR-321; 1977; 16P 5REFS  
Availability: CORPORATE AUTHOR

HS-022 690

# **STUDY OF MOTOR VEHICLE SIGNAL SYSTEMS. FINAL REPORT**

REQUIREMENTS FOR EFFECTIVE COMMUNICATION BY MOTOR VEHICLE SIGNAL SYSTEMS ARE REVIEWED AND INVESTIGATED. AN OPERATIONAL ANALYSIS OF COMMUNICATION NEEDS IS MADE BY ANALYZING THE FULL RANGE OF POSSIBLE CONFLICTS, WEIGHING EACH ACCORDING TO ITS CONTRIBUTION TO ACCIDENT INCIDENCE. A BASIC SIGNAL SET IS DEFINED AND A SURVEY MADE OF CURRENT REGULATIONS IN AUSTRALIA AND ELSEWHERE. CURRENT PRACTICES IN AUSTRALIA ARE ESTABLISHED BY A SURVEY OF SIGNALS ON 29 OF THE MOST POPULAR MOTOR VEHICLES. COMMENTS AND RECOMMENDATIONS ARE MADE ON THE FORM AND MANNER OF SPECIFICATION OF VEHICLE SIGNAL REQUIREMENTS, FOLLOWED BY A DISCUSSION OF 44 POSSIBLE IMPROVEMENTS TO THE SIGNAL SYSTEM. BASES FOR THE DISCUSSION INCLUDE, BESIDE THE CONFLICT ANALYSIS AND SURVEY, A REVIEW OF THE LITERATURE AND FIELD OBSERVATIONS. PHOTOMETRIC REQUIREMENTS FOR SIGNALS ARE DERIVED FROM THE WORK OF FISHER AND COLE AND FROM THE CONFLICT ANALYSIS, LEADING TO DETAILED RECOMMENDATIONS FOR INTENSITY AND LUMINANCE REQUIREMENTS FOR ALL CLASSES OF SIGNALS.

by B. L. COLE; S. J. DAIN; A. J. FISHER  
UNIVERSITY OF MELBOURNE, DEPT. OF  
OPTOMETRY, AUSTRALIA  
1977; 256P REFS

Availability: DIRECTOR, ROAD SAFETY INFORMATION  
SERVICE, DEPT. OF TRANSPORT, COMMONWEALTH  
OF AUSTRALIA, BOX 1839Q, G.P.O., MELBOURNE 3001,  
AUSTRALIA

HS-022 691

# **POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT**

A RECENT STUDY OF RAILROAD/HIGHWAY GRADE CROSSING WARNING-SYSTEM TECHNOLOGY EMPHASIZED DETERMINATION OF THE POTENTIAL FOR SIGNIFICANT REDUCTION IN EQUIPMENT, INSTALLATION, AND MAINTENANCE COSTS THROUGH IMPROVEMENTS SOUGHT WITHIN A FRAMEWORK OF THE BASIC (TRACK CIRCUIT) SYSTEM CONCEPTS NOW PREVALENT. A COMPREHENSIVE SURVEY OF CURRENT PRACTICES AND HARDWARE, AN ANALYSIS OF ALL MAJOR COST ELEMENTS, AND A CONSIDERATION OF POTENTIALLY BENEFICIAL TECHNICAL CHANGES ARE PRESENTED. THE EFFORT IS CONCENTRATED ON THE EQUIPMENT INVOLVED IN TRAIN DETECTION AND THE ACTIVATION OF WARNING DEVICES. SPECIAL ATTENTION IS GIVEN TO EUROPEAN PRACTICES. THE APPLICABILITY OF EUROPEAN SIGNAL RELAYS AND OF MERCURY-WETTED REED RELAYS TO THE NORTH AMERICAN SITUATION IS ANALYZED. IT IS RECOMMENDED THAT FIELD INSTALLATION AND TESTS BE MADE OF

THESE TWO DESIGNS AND THAT THE STANDARD 3000 VOLT INSULATION RESISTANCE REQUIREMENT BE WAIVED TO ACHIEVE THE POTENTIAL FOR LOWER COST AND SMALLER SIZE IN SIGNAL RELAYS.

by C. L. DUVIVIER; L. M. ROGERS; W. SHEFFIELD; H. J. FOSTER  
STORCH ENGINEERS, 824 BOYLSTON ST., CHESTNUT HILL, MASS. 02167  
DOT-TSC-870  
Rept. No. FRA/ORD-77/45.I; DOT-TSC-FRA-76-21.I; 1977;  
178P 3REFS  
REPT. FOR JUN 1974-MAR 1976.  
Availability: NTIS

HS-022 692

# **POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE AND RELAY DEVICES AND TECHNIQUES. FINAL REPORT**

CONSIDERATION IS GIVEN TO THE PROPERTIES OF SOLID-STATE CIRCUITS, MINIATURE RELAYS, AND LARGE GRAVITY-OPERATED RELAYS WHEN APPLIED TO CONTROL SYSTEMS FOR GRADE CROSSINGS EQUIPPED WITH TRAIN-ACTIVATED MOTORIST WARNINGS. FACTORS DISCUSSED INCLUDE ORIGINAL COST AND SERVICE-LIFE COST, VULNERABILITY TO ENVIRONMENT, RELIABILITY AND FAIL-SAFETY, POWER REQUIREMENTS, MAINTAINABILITY, COMPLEXITY OF TASKS TO BE PERFORMED AND ECONOMIC SCALE. WHEN THESE FACTORS ARE WEIGHED, IT IS CONCLUDED THAT A CHANGE FROM THE USE OF LARGE GRAVITY RELAYS WILL INVOLVE THE USE OF SOLID-STATE TECHNIQUES SINCE THESE SOLVE THE PROBLEM OF MOVING-PART FAILURE IN LARGE SYSTEMS, MINIATURE RELAYS BEING MORE PRONE TO MECHANICAL FAILURE THAN THE GRAVITY SYSTEMS THEY REPLACE.

by F. ROSS HOLMSTROM  
UNIVERSITY OF LOWELL RES. FOUNDATION, 450 AIKEN ST., LOWELL, MASS. 01854  
DOT-TSC-589  
Rept. No. FRA/ORD-77/45.II; DOT-TSC-FRA-76-21.II; 1977;  
50P 19REFS  
REPT. FOR MAR 1975-MAR 1976.  
Availability: NTIS

HS-022 693

# **DEATH AND INJURY ROAD ACCIDENTS IN NORTHERN IRELAND 1976**

THE 1976 ACCIDENT FIGURES FOR NORTHERN IRELAND INDICATE AN UPWARD TREND IN ACCIDENTS WITH A SLIGHT REDUCTION IN DEATH AND INJURY FIGURES. THE NUMBER OF CHILD ACCIDENTS IS THE LOWEST SINCE 1959 AND CHILD FATALITIES THE LOWEST SINCE 1963. OLDER PEDESTRIANS WERE RESPONSIBLE FOR AND WERE VICTIMS OF AN INCREASED NUMBER OF ACCIDENTS, THE PRINCIPAL CAUSATION FACTORS BEING DRUNKENNESS AND FAILURE TO EXERCISE CARE IN CROSSING

STREETS. DRINKING WAS RESPONSIBLE FOR AN INCREASED NUMBER OF FATAL ACCIDENTS, BEING THE MOST COMMON OVERALL FACTOR IN SUCH ACCIDENTS. MOTORCYCLE ACCIDENTS INCREASED, THE 27 FATALITIES BEING THE HIGHEST NUMBER ON RECORD, WITH 43.1% OF THE MOTORCYCLISTS BEING JUDGED AT FAULT IN ALL MOTORCYCLE ACCIDENTS. ROAD ACCIDENT STATISTICS FOR 1976 ARE PRESENTED IN SUMMARY, IN GRAPHS, AND IN TABLES.

ROYAL ULSTER CONSTABULARY, TRAFFIC DIV.  
HEADQUARTERS, ALEXANDER RD., BELFAST,  
NORTHERN IRELAND  
1977; 51P

Availability: CORPORATE AUTHOR

HS-022 694

### **ANALYSIS OF THE MANDATORY MOTORCYCLE HELMET ISSUE**

ALL AVAILABLE STATEMENTS AND DATA HAVE BEEN COLLECTED AND ANALYZED WHICH REPRESENT THE CONFLICTING CLAIMS OF THOSE FOR AND AGAINST MANDATORY HELMET LAWS. PERSONAL CONTACTS WERE MADE IN STATES WHICH HAVE RECENTLY REPEALED SUCH LAWS. PRESENT AND HISTORICAL PENNSYLVANIA DATA HAVE BEEN EXAMINED TO DETERMINE THE EFFECT OF THE CURRENT MANDATORY HELMET LAW ON THE TRAFFIC ACCIDENT PICTURE. RESULTS OF PUBLIC AND MOTORCYCLISTS' ATTITUDE SURVEYS HAVE ALSO BEEN INCLUDED. IT WAS CONCLUDED THAT HELMETS PLAY A SIGNIFICANT ROLE IN PREVENTING SERIOUS HEAD INJURY AND THAT THEY DO NOT CAUSE INJURIES AND/OR FATALITIES. NEITHER DO THEY CONTRIBUTE TO OR CAUSE ACCIDENTS THROUGH VISION OR HEARING IMPAIRMENT OR THROUGH A FEELING OF OVERCONFIDENCE. MANDATORY HELMET LAWS SIGNIFICANTLY INCREASE HELMET USAGE BY MOTORCYCLISTS. THE DATA ARE NOT CONCLUSIVE AS TO WHETHER MANDATORY HELMET LAWS CAN PRODUCE A REDUCTION IN MOTORCYCLISTS' FATALITIES AND INJURIES. LAWS REQUIRING PERSONS TO PROTECT THEMSELVES FROM SERIOUS INJURY AND DEATH HAVE BEEN HELD TO BE CONSTITUTIONAL. MOTORCYCLE ACCIDENTS PRODUCE SIGNIFICANT COSTS TO SOCIETY IN GENERAL. THE DIFFERENTIAL TREATMENT OF MOTORCYCLISTS BROUGHT ABOUT BY MANDATORY HELMET LAWS IS NECESSARILY PREJUDICIAL, NOT LEGALLY DISCRIMINATORY IN THE NARROW, NEGATIVE SENSE. AN OVERWHELMING PERCENTAGE (92%) OF THE PUBLIC AND A LARGE MAJORITY (79%) OF MOTORCYCLISTS BELIEVE THAT HELMETS ARE EFFECTIVE IN REDUCING INJURIES, WITH 87% OF THE GENERAL PUBLIC AND 55% OF MOTORCYCLISTS BELIEVING THAT THE GOVERNMENT SHOULD REQUIRE MANDATORY USE OF MOTORCYCLE HELMETS.

by HARRY E. BALMER, JR.  
PENNSYLVANIA DEPT. OF TRANSPORTATION,  
GOVERNOR'S TRAFFIC SAFETY COUNCIL,  
HARRISBURG, PA. 17120  
1977; 136P REFS  
Availability: NHTSA

HS-022 695

### **THE COMPLETE BOOK OF AUTOMOBILE BODY DESIGN**

AN ATTEMPT HAS BEEN MADE TO STANDARDIZE AUTOMOBILE BODYWORK TERMINOLOGY FOR THE BENEFIT OF HISTORIC CAR ENTHUSIASTS. BODY TYPES ARE COLLATED AND DESCRIBED, WHETHER GENERIC, DERIVATIVE, OR CONTRIVED, BY COACHBUILDERS AND AUTOMOBILE MANUFACTURERS. MOST OF THE BODYWORK VARIATIONS ARISE FROM THE PERIOD BETWEEN THE TWO WORLD WARS. SIDE-VIEW LINE DRAWINGS ARE PROVIDED AS ILLUSTRATIONS. A PORTFOLIO OF DESIGNS BY 55 BRITISH, EUROPEAN, AND AMERICAN COACHBUILDERS IS PRESENTED IN ORDER TO UNDERLINE THE EXTENSIVE SPECTRUM AND INGENUITY OF BODY TYPES AND STYLES. INCLUDED ARE BRIEF BIOGRAPHICAL DETAILS OF THE FEATURED COACH BUILDING COMPANIES. THE EVOLUTION IN DESIGN IS TRACED, VIA TEXT AND ILLUSTRATION, OF TEN REPRESENTATIVE BODY TYPES.

by IAN BEATTIE

1977; 138P

A FOULIS MOTORING BOOK.

Availability: HAYNES PUBLISHING GROUP,  
SPARKFORD, YEovil, SOMERSET BA22 7JJ, ENGLAND

HS-022 696

### **TOXIC GASES IN HEAVY DUTY DIESEL TRUCK CABS. FINAL REPORT**

AN EXPERIMENTAL PROGRAM WAS CONDUCTED TO MEASURE THE CAB CONCENTRATIONS OF SEVERAL TOXIC GASES THROUGHOUT A SIGNIFICANT CROSS SECTION OF CONDITIONS AND VEHICLES COMPRISING HEAVY DUTY DIESEL TRUCK POPULATION AND USE. AMBIENT AND IN-CAB CONCENTRATIONS WERE CONTINUOUSLY MEASURED FOR CARBON MONOXIDE, NITRIC OXIDE, AND NITROGEN DIOXIDE. SUPPLEMENTAL AIRBAG SAMPLES WERE ANALYZED FOR SULFUR OXIDES AND TOTAL HYDROCARBONS. THESE DATA WERE USED TO ASSESS THE POTENTIAL FOR PERFORMANCE AND HEALTH DEGRADATION DUE TO VEHICLE SELF-CONTAMINATION. A TRACER GAS, SULFUR HEXAFLUORIDE, WAS USED TO DELINEATE THE RELATIVE IMPORTANCE OF VARIOUS EMISSION SOURCE LOCATIONS AND CAB ENTRANCE PATHWAYS. THE TRACER TESTS SHOWED THAT CAB FLOOR OPENINGS SERVE AS A PRINCIPAL PATHWAY FOR ENGINE COMPARTMENT GAS TRANSMISSION INTO THE CAB. EIGHTY-EIGHT TRACTORS WERE SURVEYED BY IDLING AND/OR ROAD TESTS. A STATISTICAL CORRELATION WAS ESTABLISHED BETWEEN VEHICLE-INDUCED ELEVATED IN-CAB CONCENTRATIONS OF SPECIFIC GASES AND SEVERAL TESTING PARAMETERS INCLUDING: CONDITION OF WINDOWS, TYPE OF CAB CONFIGURATION AND THE PRESENCE OF EXHAUST LEAKS AND UNDERSIDE CAB OPENINGS. MANY VEHICLES WERE FOUND TO HAVE IN-CAB CONCENTRATIONS OF GREATER THAN 0.5 PPM NITROGEN DIOXIDE (NO<sub>2</sub>) WHICH IS CONSIDERED BY NATIONAL INST. FOR SAFETY AND HEALTH (NIOSH) TO BE A SIGNIFICANT OCCUPATIONAL EXPOSURE CONCEN-

TRATION. NO2 CONCENTRATIONS WERE OFTEN SUFFICIENTLY HIGH TO BE A HEALTH CONCERN FOR DRIVERS SUFFERING FROM PREEXISTING HEART OR RESPIRATORY PROBLEMS. COMBINED CONDITIONS OF DRIVING AT HIGH ALTITUDES, DRIVER SMOKING, ELEVATED AMBIENT LEVELS OF CARBON MONOXIDE (CO), PREEXISTING DEGRADED DRIVER HEALTH, AND CO LEAKAGE INTO THE TRUCK CAB MAY CREATE CARBOXYHEMOGLOBIN LEVELS IN THE BLOOD SUFFICIENT TO ADVERSELY AFFECT HEALTH AND PERFORMANCE. DIESEL VEHICLE CO SELF-CONTAMINATION DOES NOT PRESENT A MAJOR CONTRIBUTION. NITRIC OXIDE LEVELS WERE NOT THOUGHT TO BE A PROBLEM.

by R. ZISKIND; T. CARLIN; M. AXELROD; R. W. ALLEN; S. H. SCHWARTZ  
SCIENCE APPLICATIONS, INC., 1801 AVE. OF THE STARS, SUITE 1205, LOS ANGELES, CALIF. 90067  
DOT-FH-11-9186  
Rept. No. FHWA-RD-77-139; SAI-260-78-518; 1977; 111P  
88REFS  
REPT. FOR OCT 1976-OCT 1977.  
Availability: NTIS

HS-022 697

#### **HIGHWAY ADVISORY RADIO IN CONSTRUCTION AREAS. FINAL REPORT**

A GROUP OF 27 MEN AND 27 WOMEN USED THE HUMAN FACTORS DRIVING SIMULATOR AND WATCHED A MOTION PICTURE OF A CONSTRUCTION WORK AREA THAT WAS TAKEN THROUGH THE WINDSHIELD OF AN AUTOMOBILE AS THE SUBJECTS "DROVE." SIMULATED RADIO MESSAGES WERE GIVEN THAT DESCRIBED THE FEATURES OF THE WORK AREA. SUBJECTS HAD TO INDICATE THEIR PREFERENCE BETWEEN A LONGER DETAILED MESSAGE AND A SHORTER GENERAL MESSAGE FORMAT. THE MESSAGES WERE PRESENTED AT THREE DIFFERENT TIMES BEFORE THE CONSTRUCTION AREA ON THE FILM BEGAN. A QUESTIONNAIRE WAS USED TO ELICIT THE RESPONSES FROM THE SUBJECTS. THE SHORTER MESSAGE WAS PREFERRED BY 81% OF THE SUBJECTS, THE MAJOR REASON BEING LACK OF UNNECESSARY DETAIL. IT WAS FOUND THAT MESSAGES CAN BE GIVEN WHICH FINISH AS LATE AS 15 SECONDS BEFORE A DETOUR, AND THAT SUBJECTS REGARDED CONSTRUCTION MESSAGES AS SAFETY DEVICES. HWY. ADVISORY RADIO (HAR) WAS FOUND HELPFUL BY THE MAJORITY OF SUBJECTS.

by FRANK P. GATLING  
FEDERAL HWY. ADMINISTRATION, TRAFFIC SYSTEMS DIV., WASHINGTON, D.C. 20590  
Rept. No. FHWA-RD-77-168; 1977; 20P 8REFS  
Availability: NTIS

HS-022 698

#### **A STATUS REPORT ON VEHICLE DETECTORS. FINAL REPORT**

A STATUS SUMMARY IS PRESENTED OF VEHICLE DETECTOR TECHNOLOGY UTILIZED FOR TRAFFIC CONTROL AND ROAD COUNTING APPLICATIONS, IN-

CLUDING BACKGROUND INFORMATION ON VEHICLE DETECTORS, A CATALOGING OF COMMERCIALY AVAILABLE DETECTOR TYPES, AND A FIELD RESPONSE SUMMARY ON CURRENT VEHICLE DETECTOR USAGE, PARTICULARLY THAT OF THE INDUCTIVE LOOP DETECTOR OR ILD. TYPES OF VEHICLE DETECTORS INCLUDE OPTICAL (E.G. PHOTOCELL), ACOUSTICAL OR SONIC (E.G. PULSED), PRESSURE (E.G. TREADLE OR PNEUMATIC TUBE), MAGNETIC (E.G. INDUCTION MAGNETOMETER), AND ELECTROMAGNETIC (E.G. RADAR OR INDUCTIVE LOOP). DETAILS OF THE ILD INSTALLATION AND ELECTRONICS ARE GIVEN. THE SELF-POWERED VEHICLE DETECTOR (SPVD) MAY ALLEVIATE THE ILD'S LARGEST PROBLEM, THAT OF LOOP OR LEAD-IN CUT UP. THE SPVD REQUIRES A RADIO FREQUENCY SPECTRUM ALLOCATION, HOWEVER, WHICH MAY PRESENT ITS OWN PROBLEMS FOR LARGE-SCALE USAGE. AN OPTIMAL DETECTOR HAS NOT BEEN DEVELOPED.

by WARREN F. DORSEY  
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Rept. No. FHWA-RD-77-137; 1976; 92P REFS  
REPT. FOR 1 JUL 1975-30 NOV 1976.  
Availability: NTIS

HS-022 699

#### **CALIFORNIANS LEAD THE WAY IN DEVELOPMENT OF ELECTRIC CARS**

THE ELECTRIC AUTO ASSOC. (EAA), STARTED IN 1967, WAS THE FIRST OF ITS KIND IN THE U.S. EAA MEMBERS ARE GIVING IMPETUS TO THE NATIONAL DEMAND FOR THE DEVELOPMENT OF A PRACTICAL ELECTRIC AUTOMOBILE AND HAVE FOCUSED CONGRESSIONAL ATTENTION ON THE NEED. THE EAA'S MAIN PURPOSE IS TO PROVIDE INFORMATION ON ELECTRIC CAR DESIGN AND CONSTRUCTION, TO ENCOURAGE BUILDING OF ELECTRIC CARS, AND TO ORGANIZE EXHIBITS OF CARS BUILT BY EAA MEMBERS. THE ASSOCIATION PROVIDES A MONTHLY NEWSLETTER AND A SPECIAL LIBRARY ON ELECTRIC CAR TECHNIQUES AND PROBLEMS. THE ELECTRIC VEHICLE ASSOC. OF OHIO HAS CONVERTED 24 CARS TO ELECTRIC POWER. THE ASSOCIATION'S PRESIDENT, DR. KARL KORDESH, WAS THE FIRST TO DEVELOP THE HYBRID ELECTRIC AUSTIN WITH HYDROGEN FUEL CELLS AND A BATTERY (SINCE CONVERTED FROM LEAD TO ICE BATTERY). THE FEDERAL GOVERNMENT PLANS TO INVEST \$160 MILLION IN RESEARCH ON ELECTRIC AND HYBRID VEHICLES. A SIGNIFICANT DEVELOPMENT IN ELECTRIC CAR TECHNOLOGY WAS FORD'S 1966 DEVELOPMENT OF A NEW SODIUM SULFUR BATTERY WITH ADEQUATE POWER, LONG ENERGY LIFE, AND FAIR COMPACTNESS. THE ENERGY RES. AND DEVEL. ADMINISTRATION (ERDA) IS SEEKING A CAR THAT CAN ATTAIN A TOP SPEED OF 75 MPH AND A RANGE OF 75 MILES BETWEEN BATTERY RECHARGINGS, IN A PRICE RANGE OF \$5000 OR LESS, AND CAPABLE OF OPERATING 100,000 MILES AT NOT OVER 15 CENTS A MILE. GENERAL ELECTRIC IS BUILDING TWO NEW SUBCOMPACT ELECTRICS, "INTEGRATED TEST VEHICLES," FOR MOBILITY, ADAPTABILITY, UTILITARIAN

August 31, 1978

HS-022 701

VALUE, PASSENGER COMFORT, AND SERVICE. THE CONTROLS ARE DESIGNED TO BE THE SAME AS ON GASOLINE POWER VEHICLES, WITH POWER SUPPLIED TO A DIRECT CURRENT MOTOR BY 18 BATTERIES WHICH ARE RECHARGED WHILE DRIVING AND MAY ALSO BE RECHARGED ON 120 VOLT HOUSE CURRENT. SEARS ROEBUCK AND CO. IS SPONSORING AN EXPERIMENTAL ELECTRIC, XDH-I, WITH A TOP SPEED OF 75 MPH AND A 90 MILE RANGE. AMERICAN MOTORS MANUFACTURED 352 ELECTRIC DELIVERY VANS FOR THE U.S. POSTAL SERVICE. THE NATIONAL PARKS COMMISSION USES ELECTRIC-POWERED TRASH PICKUP TRUCKS. LINEAR ALPHA, INC. HAS DEVELOPED TWO ELECTRIC CARS, THE THUNDERBOLT AND THE GAMETIME 120. ELECTRIC CARS HAVE BEEN FOUND TO PROVIDE RELIABLE SERVICE IN ALL TYPES OF WEATHER. INCREASED SPEED AND RANGE IN ELECTRIC CARS, INCREASED PRICES OF GASOLINE, AND INCREASED PROBLEMS OF POLLUTION COMBINE TO INCREASE THE POPULARITY OF ELECTRIC CARS. AMONG ARDENT ELECTRIC CAR SUPPORTERS ARE CONGRESSMEN AND ANTIQUE CAR DRIVERS. DETRIMENTS TO THE POPULARITY OF ELECTRIC CARS ARE HIGH PRICES, AND BATTERY WEIGHT, SPACE, AND FREQUENCY OF RECHARGE. DEVELOPMENT OF NEW POWERPLANTS, SUCH AS THE LITHIUM-IRON SULFIDE BATTERY AND THE NICKEL-ZINC BATTERY, COULD ALLEVIATE PART OF THE PROBLEM.

by WILLIAM L. ROPER  
Publ: CALIFORNIA HIGHWAY PATROLMAN V41 N12  
(FEB 1978) P6-7, 27, 30-31, 34-35, 38-39  
1978  
Availability: SEE PUBLICATION

HS-022 700

#### **EVALUATION OF MEETING BEAMS OF TWO- AND THREE-BEAM HEADLIGHTING SYSTEMS**

THE VALIDITY OF A COMPUTER SIMULATION MODEL FOR PREDICTING VISIBILITY WITH HEADLIGHT BEAMS WAS EVALUATED, AND ADDITIONAL COMPARATIVE DATA WERE OBTAINED ON THE EFFECTIVENESS OF MID BEAMS COMPARED TO CONVENTIONAL LOW BEAMS. A COMPARISON WAS MADE OF SIMULATION RESULTS WITH THOSE OBTAINED IN A FIELD TEST OF FIVE BEAMS FOR TARGETS POSITIONED AT THE RIGHT AND LEFT SIDE OF THE LANE. THE AGREEMENT OBTAINED WAS GENERALLY GOOD THROUGHOUT THE MEETING OF TWO OPPOSING VEHICLES. THE DISCREPANCY BETWEEN SIMULATION AND FIELD TEST RESULTS WAS GREATEST FOR THE VISIBILITY OF TARGETS AT THE RIGHT SIDE OF THE LANE WHEN THE VEHICLES WERE CLOSE TO THE MEETING POINT. THIS ERROR WAS EXPLAINED AS DUE TO VARIATION IN FIELD TEST RESULTS. THE RESULTS SHOW THAT THE MODEL PREDICTS WITHIN THE ERROR OF THE FIELD TEST PROCEDURES. WHILE THERE WERE NO DIFFERENCES BETWEEN THE LOW BEAMS OR THE MID BEAMS FOR VISIBILITY OF TARGETS AT THE LEFT OF THE LANE, INCREASES IN VISIBILITY OF UP TO 30% WERE ATTAINED WITH MID BEAMS COMPARED TO THE U.S. OR ECONOMIC COMMISSION FOR EUROPE (E.C.E.) LOW BEAMS FOR VISIBILITY OF

TARGETS AT THE RIGHT EDGE OF THE LANE. AN IMPROVED HEADLIGHTING MEETING BEAM CONFIGURATION WAS SUGGESTED CONSISTING OF THE E.C.E. LOW BEAMS, FOR URBAN DRIVING, AND ADDING A LAMP SIMILAR TO THE TYPE III LAMP TO FORM A MID BEAM FOR USE AS A MEETING BEAM ON RURAL ROADS.

by R. G. MORTIMER; P. L. OLSON  
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN;  
UNIV. OF MICHIGAN  
Rept. No. SAE-770237; 1977; 11P 11REFS  
PRESENTED AT INTERNATIONAL AUTOMOTIVE CONGRESS AND EXPOSITION, DETROIT, 28 FEB-4 MAR 1977. STUDY UNDER CONTRACT WITH MOTOR VEHICLE MANUFACTURERS ASSOC. OF THE U.S., INC.  
Availability: SAE

HS-022 701

#### **HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM**

THE DEVELOPMENT AND CONSTRUCTION OF A HIGH-SPEED X-RAY CINEMATOGRAPHIC SYSTEM WERE COMPLETED FOR USE IN BIOMECHANICS RESEARCH, THE OPERATIONAL CHARACTERISTICS OF THE SYSTEM IN APPLICATION WERE DETERMINED, AND THE SYSTEM WAS PHASED INTO ONGOING BIOMECHANICAL RESEARCH PROGRAMS AT THE HWY. SAFETY RES. INST. THIS SYSTEM CONSISTS OF A HIGH-SPEED 16-MM MOTION PICTURE CAMERA WHICH VIEWS A TWO-INCH DIAMETER OUTPUT PHOSPHOR OF A HIGH-GAIN FOUR-STAGE, MAGNETICALLY FOCUSED IMAGE INTENSIFIER TUBE, GATED ON AND OFF SYNCHRONOUSLY WITH SHUTTER PULSES FROM THE MOTION PICTURE CAMERA. A LENS OPTICALLY COUPLES THE INPUT PHOTOCATHODE OF THE IMAGE INTENSIFIER TUBE TO X-RAY IMAGES PRODUCED ON A FLUORESCENT SCREEN BY A SMOOTHED DIRECT-CURRENT X-RAY GENERATOR. THE SYSTEM IS ADAPTABLE TO A VARIETY OF EXPERIMENTAL CONFIGURATIONS BECAUSE FLUORESCENT SCREEN SIZE AND TYPE CAN BE RELATIVELY EASILY AND INEXPENSIVELY CHANGED. HIGH-SPEED X-RAY CINERADIOGRAPHS AT 1000 FRAMES PER SECOND HAVE BEEN OBTAINED OF BIOLOGICAL AND NONBIOLOGICAL MATERIALS DURING IMPACT EVENTS. IMAGE QUALITY IN TERMS OF CONTRAST AND RESOLUTION HAS BEEN FOUND TO BE STRONGLY DEPENDENT ON JUDICIOUS INTRODUCTION OF CONTRAST MEDIA AND TARGETING MATERIAL IN SPECIMENS UNDER INVESTIGATION.

by JOHN W. MELVIN; MAX BENDER  
UNIVERSITY OF MICHIGAN, HWY. SAFETY RES. INST., ANN ARBOR, MICH. 48109  
ENG-75-22768  
Rept. No. UM-HSRI-78-10; 1978; 15P 6REFS  
SPONSORED BY NATIONAL SCIENCE FOUNDATION, ENGINEERING DIV., WASHINGTON, D.C. 20550. REPT. FOR 15 OCT 1975-31 MAR 1977.  
Availability: CORPORATE AUTHOR

HS-022 704

HS-022 704

**THE RELATIVE MERITS OF DIFFERENT LOW BEAM HEADLIGHTING SYSTEMS - A REVIEW OF THE LITERATURE. FINAL REPORT**

THE HISTORICAL DEVELOPMENT OF AUTOMOTIVE HEADLIGHTING IS REVIEWED AND THE DIFFERENCES DESCRIBED BETWEEN EUROPEAN AND AMERICAN CONCEPTS IN TERMS OF PHOTOMETRICS, CONSTRUCTION, AND THE QUALITY OF VISIBILITY AFFORDED, INCLUDING THE ADVANTAGES AND DISADVANTAGES OF EACH SYSTEM. RESEARCH IS DESCRIBED WHICH COMPARES EUROPEAN AND AMERICAN HEADLIGHTING SYSTEMS IN PHOTOMETRICS, CONSTRUCTION, AND AIMING. LITTLE OR NO DIFFERENCE WAS FOUND IN MOST REPORTS, AND FOR THOSE STUDIES WHICH FOUND LARGER DIFFERENCES, THERE WAS NO AGREEMENT AS TO WHICH SYSTEM IS BETTER. NO METHOD OF OBJECTIVE EVALUATION PRESENTLY EXISTS. AN ANNOTATED BIBLIOGRAPHY IS PROVIDED.

by PAUL L. OLSON  
UNIVERSITY OF MICHIGAN, HWY. SAFETY RES.  
INST., ANN ARBOR, MICH. 48109  
TSP-110  
Rept. No. UM-HSRI-77-55; 1977; 105P REFS  
SPONSORED BY CALIFORNIA OFFICE OF TRAFFIC  
SAFETY, P.O. BOX 865, SACRAMENTO, CALIF. 95804.  
REPT. FOR 19 OCT-19 DEC 1977.  
Availability: CORPORATE AUTHOR

HS-802 510

**NATIONAL HIGHWAY SAFETY ADVISORY COMMITTEE ON ALCOHOL SAFETY ADJUDICATION. FINAL REPORT**

CURRENT FINDINGS AND RECOMMENDATIONS OF THE NATIONAL HWY. SAFETY ADVISORY COM.'S (NHSAC) TASK FORCE ON ADJUDICATION ARE PRESENTED. THE TASK FORCE CONCENTRATED ITS EFFORTS ON THE FOLLOWING THREE ASPECTS OF THE ADJUDICATION AND SENTENCING OF DRINKING DRIVER CASES: SENTENCING SYSTEMS DESIGNED SINCE 1971 BY THE JURISDICTIONS COOPERATING WITH THE ALCOHOL SAFETY ACTION PROG. (ASAP), A HEALTH-LEGAL SENTENCING APPROACH FOR THE REFERRAL TO TREATMENT OF DRINKING DRIVER OFFENDERS; JUDICIAL EDUCATION IN ALCOHOL AND HIGHWAY SAFETY; AND RELATED ACTIVITIES OF THE DEPT. OF JUSTICE (LAW ENFORCEMENT ASSISTANCE ADMINISTRATION, LEAA), THE DEPT. OF HEALTH, EDUCATION, AND WELFARE (NATIONAL INST. OF ALCOHOL ABUSE AND ALCOHOLISM, NIAAA), THE AMERICAN BAR ASSOC., AND THE AMERICAN JUDGES ASSOC. WITH RESPECT TO ASAP ADJUDICATION, IT IS FELT THAT THERE SHOULD BE CONTINUED IMPLEMENTATION OF BASIC ASAP SYSTEM MANAGEMENT CONCEPTS, FOSTERED BY HIGHWAY SAFETY AGENCIES AND THERE SHOULD BE FURTHER NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION (NHTSA) SUPPORT FOR EXISTING ASAP ADJUDICATION STRUCTURES AND EXPANSION TO OTHER JURISDICTIONS, BACKED BY SPECIFIC ALLOCATIONS OF DEPT. OF TRANSPORTATION (DOT) FUNDS. RECOMMENDA-

HSL 78-08

TIONS ARE ALSO OUTLINED FOR THE SPECIFIC ELEMENTS OF THE ASAP ADJUDICATIVE PROCESS, SANCTIONING APPROACHES AND EFFECTIVENESS, AND LOWER COURT STRUCTURE AND RESOURCES. WITH RESPECT TO JUDICIAL EDUCATION, IT WAS FOUND THAT MOST ADJUDICATORS DO NOT UNDERSTAND HOW TO HANDLE DRINKING DRIVING CASES PURPOSEFULLY, DO NOT GIVE SPECIAL ATTENTION TO SENTENCING SYSTEMS AND RESOURCES, AND ARE UNAWARE OF ASAP-DEVELOPED PRINCIPLES, PROCEDURES, AND OBJECTIVES. ASAP HAS SIGNIFICANTLY CHANGED THE ATTITUDES, KNOWLEDGE, AND BEHAVIOR OF THOSE JUDGES EXPOSED TO ASAP; SUCH CHANGES WOULD NOT HAVE OCCURRED WITHOUT ASAP. THE SYSTEM MANAGEMENT CONCEPT USED BY ASAP HAS VERY SUCCESSFULLY ESTABLISHED LIAISON AMONG AGENCIES AT THE LOCAL LEVEL, COOPERATION HAS BEGUN AT THE STATE LEVEL, AND RELATIONSHIPS AT THE FEDERAL LEVEL NEED STRENGTHENING. APPENDICES CONTAIN THE FOLLOWING: SPECIAL SUBCOMMITTEE REPORTS (USE OF MANDATORY SANCTIONS BY THE COURTS AND JUDICIAL EDUCATION IN ALCOHOL SAFETY), SUMMARIES OF ASAP SITE VISITS (PHOENIX, CINCINNATI, LOS ANGELES), LIAISON ACTIVITIES WITH THE NHSAC, NHSAC RESOLUTIONS, AND A BIBLIOGRAPHY.

NATIONAL HWY. TRAFFIC SAFETY  
ADMINISTRATION, WASHINGTON, D.C. 20590  
1977; 51P REFS  
Availability: NTIS

HS-803 223

**AUTOMOTIVE FLEET FUEL CONSUMPTION MODEL: FUEL. FOR. FINAL REPORT**

A COMPUTER PROGRAM, FUEL, HAS BEEN DEVELOPED WHICH CALCULATES POTENTIAL FUEL CONSERVATION BENEFITS RESULTING FROM IMPROVEMENTS IN AUTOMOBILE FUEL ECONOMY. THE FORTRAN PROGRAM WAS DESIGNED TO ASSIST THE OFFICE OF FUEL ECONOMY OF THE NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION (NHTSA) IN ITS SELECTION OF FUEL ECONOMY STANDARDS FOR DOMESTICALLY MANUFACTURED PASSENGER CARS. FUEL ACCEPTS SIX ESSENTIAL USER-SPECIFIED DATA FILES CONTAINING THE FOLLOWING: A SCHEDULE OF NEW CAR REGISTRATIONS BY MODEL YEAR, BOTH HISTORIC AND PROJECTED; A SCHEDULE OF MILES TRAVELED ANNUALLY BY A CAR AS A FUNCTION OF ITS AGE; A SCHEDULE OF VEHICLE SURVIVAL PROBABILITY AS A FUNCTION OF AGE; A DESCRIPTION OF AVERAGE FUEL ECONOMY, BY MODEL YEAR, OF THE EXISTING FLEET; A HYPOTHETICAL BASELINE SCHEDULE OF NEW CAR FUEL ECONOMY BY MODEL YEAR; AND A HYPOTHETICAL IMPROVED SCHEDULE OF NEW CAR FUEL ECONOMY BY MODEL YEAR. BENEFITS ARE REPORTED IN TERMS OF THE FOLLOWING THREE QUANTIFIERS: ANNUAL FUEL SAVINGS (BILLIONS OF GALLONS), CUMULATIVE FUEL SAVINGS (BILLIONS OF BARRELS), AND DISCOUNTED CUMULATIVE CASH SAVINGS (BILLIONS OF DOLLARS). IMPACTS UPON AGGREGATE CONSUMER OUTLAY FOR FUEL, UPON LIFETIME OPERATING COST (PER



August 31, 1978

HS-803 252

AUTO), AND UPON FEDERAL AND STATE EXCISE TAX REVENUES ARE ALSO CALCULATED.

by JERRY HORTON  
TRANSPORTATION SYSTEMS CENTER, KENDALL  
SQUARE, CAMBRIDGE, MASS. 02142  
Rept. No. DOT-TSC-NHTSA-78-1; 1978; 55P 5REFS  
REPT. FOR JUN-SEP 1977.  
Availability: NTIS

HS-803 249

**RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 1:  
EXECUTIVE SUMMARY. FINAL REPORT**

by D. FRIEDMAN; D. STRUBLE  
MINICARS, INC., 35 LA PATERA LANE, GOLETA,  
CALIF. 93017  
DOT-HS-5-01215  
1977; 24P  
REPT. FOR JUL 1975-DEC 1976. FOR ABSTRACTS, SEE  
HS-803 250--HS-803 252.  
Availability: NTIS

HS-803 250

**RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2:  
COMPREHENSIVE TECHNICAL RESULTS. FINAL  
REPORT**

COMPREHENSIVE TECHNICAL RESULTS OBTAINED DURING THE DESIGNING, DEVELOPMENT, AND TESTING OF AN RSV (RESEARCH SAFETY VEHICLE) PROTOTYPE TO MEET THE DESIRED NATIONAL SOCIAL GOALS OF THE MID-1980'S IN VEHICLE CRASH-WORTHINESS, CRASH AVOIDANCE, DAMAGEABILITY, PEDESTRIAN SAFETY, FUEL ECONOMY, EMISSIONS AND COST, ARE PRESENTED. CHAPTERS CONCERNING PERFORMANCE CRITERIA AND TEST MODES INCLUDE THE FOLLOWING: ACCIDENT ANALYSIS FINDINGS; DETERMINING SIDE IMPACT TEST CONDITIONS; CONVENTIONAL CAR SIDE STRUCTURES; RELATING LABORATORY TEST RESULTS TO ACCIDENT DATA; RSV FRONT STRUCTURE OPTIMIZATION; AND THE PHASE 4 VEHICLE TEST PLAN. INFORMATION ON STRUCTURAL DEVELOPMENT IS ORGANIZED UNDER THE FOLLOWING HEADINGS: STRUCTURAL CONCEPT AND DESIGN; STRUCTURAL ANALYSIS; FOAM FORMULATION AND DEVELOPMENT; DESIGN EVOLUTION; SCALE MODEL TESTING; AND FULL SCALE CRASH TESTS. OCCUPANT AND PEDESTRIAN PROTECTION CHAPTERS INCLUDE THE FOLLOWING: GENERAL DESCRIPTION OF RESTRAINT SYSTEMS; DRIVER RESTRAINT SYSTEM; RIGHT FRONT PASSENGER RESTRAINT SYSTEM; RSV REAR PASSENGER RESTRAINT SYSTEM; SIDE IMPACT AND ROLLOVER PROTECTION, AND PEDESTRIAN PROTECTION. VEHICLE SYSTEMS DEVELOPMENT IS DISCUSSED UNDER THE HEADINGS OF GENERAL VEHICLE ARCHITECTURE, DRIVER/PASSENGER ACCOMMODATION, AND VEHICLE SYSTEMS DESCRIPTIONS. A WEIGHT AND COST ANALYSIS OF VEHICLE SYSTEMS IS GIVEN. APPENDED MATERIAL INCLUDES INFORMATION ON ADJUSTING THE MULTI-DISCIPLINARY ACCIDENT INVESTIGATION FILE; REGRESSION ANALYSIS; RSV PHASE 2 CRASH DATA; AND THIOKOL'S GAS INFLA-

TOR SPECIFICATIONS. ALTHOUGH FURTHER REFINEMENT IS NECESSARY TO ASSURE OPERATIONAL VALIDITY, IN ALL CATEGORIES OF GOALS THE RESULTS MEET OR EXCEED THE MOST ADVANCED PERFORMANCE SPECIFIED BY "THE PRESIDENTIAL TASK FORCE ON MOTOR VEHICLE GOALS BEYOND 1980."

by N. DINAPOLI; M. FITZPATRICK; C. STROTHER; D. STRUBLE; R. TANNER  
MINICARS, INC., 35 LA PATERA LANE, GOLETA,  
CALIF. 93017  
DOT-HS-5-01215  
1977; 615P 10REFS  
REPT. FOR JUL 1975-DEC 1976. SUMMARY REPT. IS HS-803 249; SUBCONTRACTOR FINAL REPTS. ARE HS-803 251 AND HS-803 252.  
Availability: NTIS

HS-803 251

**RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3A:  
SUBCONTRACTOR FINAL REPORTS. FINAL  
REPORT**

FINAL REPORTS OF RESEARCH CONDUCTED BY VARIOUS COMPANIES IN SUPPORT OF THE DEVELOPMENT OF AN RSV (RESEARCH SAFETY VEHICLE) PROTOTYPE TO MEET THE DESIRED NATIONAL SOCIAL GOALS OF THE MID-1980'S IN VEHICLE CRASH-WORTHINESS, CRASH AVOIDANCE, DAMAGEABILITY, PEDESTRIAN SAFETY, FUEL ECONOMY, EMISSIONS AND COST, ARE PRESENTED. THE COMPANIES AND THE TYPES OF WORK PERFORMED ARE AS FOLLOWS: BUDD CO. (DESIGN PRODUCTIBILITY AND MANUFACTURING SUPPORT), MAN FACTORS, INC. (HUMAN FACTORS ENGINEERING), MARC ANALYSIS RES. CORP. (STRESS ANALYSIS), AND MONSANTO RES. CORP. (FOAM AND PLASTIC SUBSYSTEM).

MINICARS, INC., 35 LA PATERA LANE, GOLETA,  
CALIF. 93017; BUDD CO.; MAN FACTORS, INC.; MARC  
ANALYSIS RES. CORP.; MONSANTO RES. CORP.  
DOT-HS-5-01215  
1977; 330P 8REFS  
REPT. FOR JUL 1975-DEC 1976. SUMMARY REPT. IS HS-803 249; TECHNICAL RESULTS ARE IN HS-803 250; OTHER SUBCONTRACTOR FINAL REPTS. ARE IN HS-803 252.  
Availability: NTIS

HS-803 252

**RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3B:  
SUBCONTRACTOR FINAL REPORTS. FINAL  
REPORT**

FINAL REPORTS OF RESEARCH CONDUCTED BY VARIOUS COMPANIES AND INSTITUTIONS IN SUPPORT OF THE DEVELOPMENT OF AN RSV (RESEARCH SAFETY VEHICLE) PROTOTYPE TO MEET THE DESIRED NATIONAL SOCIAL GOALS OF THE MID-1980'S IN VEHICLE CRASH-WORTHINESS, CRASH AVOIDANCE, DAMAGEABILITY, PEDESTRIAN SAFETY, FUEL ECONOMY, EMISSIONS AND COST, ARE PRESENTED. THE COMPANIES/INSTITUTIONS AND THE TYPES OF WORK PERFORMED ARE AS FOLLOWS: RCA LABORATORIES (ELECTRONIC

SUBSYSTEMS), STANFORD RES. INST. (SCALE MODELING), SYSTEMS TECHNOLOGY, INC. (HANDLING AND RIDE QUALITIES), AND THE UNIV. OF UTAH (BRAKING SYSTEM).

MINICARS, INC., 35 LA PATERA LANE, GOLETA, CALIF. 93017; RCA LABS.; STANFORD RES. INST.; SYSTEMS TECHNOLOGY, INC.; UNIV. OF UTAH  
DOT-HS-5-01215

1977; 377P 41REFS

REPT. FOR JUL 1975-DEC 1976. SUMMARY REPT. IS HS-803 249; TECHNICAL RESULTS ARE IN HS-803 250; OTHER SUBCONTRACTOR FINAL REPTS. ARE IN HS-803 251.

Availability: NTIS

HS-803 274

#### **EVALUATION OF SCREENING BREATH TESTING IN TRAFFIC LAW ENFORCEMENT. FINAL REPORT**

A FIELD STUDY OF THE EFFECT OF FOUR DIFFERENT SCREENING BREATH TESTING (SBT) DEVICES ON TRAFFIC LAW ENFORCEMENT WAS CONDUCTED SIMULTANEOUSLY IN SIX STATES AND DATA WERE COLLECTED FROM OVER 6000 DRIVING WHILE INTOXICATED (DWI) INVESTIGATIONS. SOME METHODOLOGICAL DIFFICULTIES WERE ENCOUNTERED, BUT THE RESULTS CONFIRM THAT THE USE OF SBT'S CAN LEAD TO AN INCREASE IN DWI ARRESTS. AN IMPACT ON BLOOD ALCOHOL CONCENTRATION (BAC) LEVELS OF DWI ARRESTS WAS NOT DEMONSTRATED BUT THERE WAS A TREND TOWARD LOWER LEVELS. THE DEVICES, OVERALL, PROVED TO BE ACCEPTABLY ACCURATE, RELIABLE, AND USEFUL, BUT SOME DIFFICULTIES AMONG THE TYPES WERE NOTED. RECOMMENDATIONS WERE MADE FOR IMPROVEMENTS IN SBT DEVELOPMENT, TRAINING, IMPLEMENTATION, AND EVALUATION.

by E. W. BISHOP; C. A. GORANSSON; J. F. OATES, JR. DUNLAP AND ASSOCIATES, INC., 1 PARKLAND DRIVE, DARIEN, CONN. 06820  
DOT-HS-5-01267

Rept. No. ED 77-8; 1977; 122P

REPT. FOR 1 JUL 1975-29 JUL 1977.

Availability: NTIS

HS-803 285

#### **INTERIM ANALYSIS OF STR [SHORT TERM REHABILITATION] PERFORMANCE AND EFFECTIVENESS. TWELVE-MONTH ANALYSES**

THE STATUS OF THE NHTSA SHORT TERM REHABILITATION STUDY (STR) AS OF DEC 1977 IS DESCRIBED AND THE PROGRESS OF DATA COLLECTION EFFORTS BY THE ELEVEN PARTICIPATING ASAP PROJECTS IS SUMMARIZED. OUTCOME MEASURES CONSIDERED AS INDICATIVE OF TREATMENT PROGRAM EFFECTS INCLUDE: INDICES OF ACCIDENT AND ARREST RECIDIVISM REFLECTIVE OF THE ACCOMPLISHMENT OF DIRECT TRAFFIC SAFETY OBJECTIVES; DIRECT MEASURES OF DRINKING/ALCOHOL INGESTION COMPARABLE TO CRITERIA EMPLOYED IN NATIONAL INST. ON ALCOHOL ABUSE AND ALCOHOLISM (NIAAA) ASSESSMENTS OF TREATMENT PROGRAMS; AND TWO SETS

OF FACTOR ANALYTICALLY DERIVED SCALES DESIGNED TO ASSESS CLIENT STATUS IN A NUMBER OF LIFE ADJUSTMENT DIMENSIONS. SITE REPORTED CHARACTERISTICS OF STR TREATMENT PROGRAMS ARE USED TO CONFIGURE A NUMBER OF QUASIEXPERIMENTAL PROGRAM LEVEL DESIGNS WHICH POOL DATA FROM THE SEVERAL STR SITES. DESIGNS PERMITTING ASSESSMENT OF THE EFFECTS OF ALCOHOL SAFETY SCHOOLS, POWER MOTIVATION TRAINING (PMT), AND A VARIETY OF STRUCTURAL TREATMENT VARIATIONS ARE REPORTED. THE RESULTS OF INTERIM STR EFFECTIVENESS ANALYSES WITHIN EIGHT SEPARATE PROGRAM LEVEL DESIGNS SHOW NO CONSISTENT EVIDENCE OF TREATMENT EFFECT FOR ANY OF THE TREATMENT GROUPINGS CONSIDERED.

by D. L. STRUCKMAN-JOHNSON; V. S. ELLINGSTAD; V. L. STRAWN  
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DOT-HS-6-01366

Rept. No. HFL-78-1; 1978; 187P 18REFS

REPT. FOR 1 JUL 1976-31 DEC 1977.

Availability: NTIS

HS-803 287

#### **NECK INJURY ASSESSMENT PROTOCOL. FINAL REPORT**

A PROTOCOL IS PRESENTED OF SUGGESTED AUTOPSY PROCEDURES BASED UPON AN AUTOPSY EXAMINATION AND STUDY OF 22 MOTOR VEHICULAR DEATHS, STUDIED AT THE DEPT. OF CHIEF MEDICAL EXAMINER-CORONER, COUNTY OF LOS ANGELES, CALIF. DETAILED EXAMINATION OF THE HEAD AND NECK INCLUDED EXAMINATION FOR EXTERNAL CONTUSIONS, ABRASIONS, LACERATIONS, ETC. RADIOLOGICAL EXAMINATION WAS FOLLOWED BY STEP-BY-STEP LAYER AUTOPSY DISSECTION OF THE HEAD AND NECK, INCLUDING LAMINECTOMY OF THE CERVICAL SPINE AND REMOVAL OF THE BRAIN AND CERVICAL SPINAL CORD AS A UNIT FOR FURTHER EXAMINATION BY THE NEUROPATHOLOGIST. A FINAL EVALUATION WAS MADE OF THE ACCUMULATED DATA. THE RELATIVE VALUE OF EACH OF THE FOREGOING STEPS WAS ESTIMATED.

by THOMAS T. NOGUCHI; IRVING REHMAN  
CHIEF MEDICAL EXAMINER-CORONER, HALL OF JUSTICE, LOS ANGELES, CALIF. 90012

DOT-HS-6-01476

1978; 39P 25REFS

REPT. FOR OCT 1976-MAR 1978.

Availability: NTIS

HS-803 312

#### **COMPILATION OF REPORTS GENERATED BY THE TIRE SYSTEMS DIVISION, SAFETY RESEARCH LABORATORY, 1967 THRU JANUARY 1978. PRELIMINARY REPORT**

A TIRE SYSTEMS BIBLIOGRAPHY IS PRESENTED OF PUBLISHED PAPERS AND REPORTS, PATENTS AND/OR INVENTION DISCLOSURES, UNPUBLISHED REPORTS (T-100 SERIES, INFORMAL AND/OR IN-

August 31, 1978

HOUSE RESEARCH REPORTS), AND REPORTS OF RESEARCH WHICH MAY OR MAY NOT BE PUBLISHED (T-1000 SERIES). OVER 1000 CITATIONS ARE INCLUDED, WITH PUBLICATION DATES RANGING FROM 1962 TO 1978.

by E. H. BEALE, COMP.  
NATIONAL HWY. TRAFFIC SAFETY  
ADMINISTRATION, WASHINGTON, D.C. 20590  
Rept. No. T-1037; 1978; 16P REFS  
NHTSA TECHNICAL NOTE. COVER TITLE BEGINS  
"TIRE SYSTEMS."  
Availability: NHTSA

HS-803 313

**EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING  
COMPOUNDS. MONTHLY PROGRESS REPORT NO.  
8, 1 OCTOBER TO 31 OCTOBER 1977**

NO TECHNICAL ACTIVITY WAS UNDERTAKEN RELATED TO COMPONENT AND SLED TESTING OF ALDERSON RES. LAB. COMPOUND A SKIN COMPONENTS, SINCE NO COMPONENTS HAVE BEEN RECEIVED.

by DANIEL E. MASSING  
CALSPAN CORP., BUFFALO, N.Y. 14221  
DOT-HS-6-01514  
Rept. No. PR-8; 1977; 3P  
Availability: REFERENCE COPY ONLY

HS-803 318

**EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING  
COMPOUNDS. MONTHLY PROGRESS REPORT NO.  
9, 1 NOVEMBER TO 30 NOVEMBER 1977**

NO TECHNICAL ACTIVITY WAS UNDERTAKEN RELATED TO COMPONENT AND SLED TESTING OF ALDERSON RES. LAB. COMPOUND A SKIN COMPONENTS, SINCE NO COMPONENTS WERE RECEIVED.

by DANIEL E. MASSING  
CALSPAN CORP., BUFFALO, N.Y. 14221  
DOT-HS-6-01514  
Rept. No. PR-9; 1977; 3P  
Availability: REFERENCE COPY ONLY

HS-803 319

**EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING  
COMPOUNDS. MONTHLY PROGRESS REPORT NO.  
10, 1 DECEMBER TO 31 DECEMBER 1977**

NO TECHNICAL ACTIVITY WAS UNDERTAKEN RELATED TO COMPONENT AND SLED TESTING OF ALDERSON RES. LAB. COMPOUND A SKIN COM-

PONENTS, SINCE NO COMPONENTS HAVE BEEN RECEIVED.

by DANIEL E. MASSING  
CALSPAN CORP., BUFFALO, N.Y. 14221  
DOT-HS-6-01514  
Rept. No. PR-10; 1977; 3P  
Availability: REFERENCE COPY ONLY

HS-803 320

**EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING  
COMPOUNDS. MONTHLY PROGRESS REPORT NO.  
11, 1 JANUARY TO 31 JANUARY 1978**

NO TECHNICAL ACTIVITY WAS UNDERTAKEN RELATED TO COMPONENT AND SLED TESTING OF ALDERSON RES. LAB. COMPOUND A SKIN COMPONENTS, SINCE NO COMPONENTS HAVE BEEN RECEIVED.

by DANIEL E. MASSING  
CALSPAN CORP., BUFFALO, N.Y. 14221  
DOT-HS-6-01514  
Rept. No. PR-11; 1978; 3P  
Availability: REFERENCE COPY ONLY

HS-803 321

**EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING  
COMPOUNDS. MONTHLY PROGRESS REPORT NO.  
12, 1 FEBRUARY TO 28 FEBRUARY 1978**

TWO COMPLETE SETS OF COMPOUND A DUMMY SKINS WERE RECEIVED FROM HUMANOID SYSTEMS, INC. AND WERE FOUND SATISFACTORY FOR THE PLANNED TESTS. ALDERSON RES. LAB. (ARL) COMPOUND A DUMMY SKINS TO BE TESTED WITH THE ARL DUMMIES WERE RECEIVED. MINOR DEFECTS WERE JUDGED NOT SIGNIFICANT. COMPONENT TESTS WERE PERFORMED ON FOUR DUMMIES CONTAINING COMPOUND A SKINS ACCORDING TO THE PROCEDURES SPECIFIED IN PART 572, AS REVISED IN DOCKET NO. 73-08, NOTICE 4, INCLUDING THORAX IMPACT, LUMBAR SPINE FLEXION, ABDOMEN PRESS, AND KNEE IMPACT TESTS. RESULTS OF THESE TESTS ARE TABULATED. ALL TEST RESULTS CONFORM TO APPLICABLE PERFORMANCE REQUIREMENTS. A SLED TEST SCHEDULE IS PROVIDED.

by DANIEL E. MASSING  
CALSPAN CORP., BUFFALO, N.Y. 14221  
DOT-HS-6-01514  
Rept. No. PR-12; 1978; 9P  
Availability: REFERENCE COPY ONLY

HS-810 314

**STATEMENT AT THE NATIONAL PRESS CLUB,  
WASHINGTON, D.C., THURSDAY, SEPT. 1, 1977**

PASSIVE RESTRAINT SYSTEMS SUCH AS AIR BAGS AND PASSIVE BELTS ARE IMPORTANT IN ELIMINAT-

CONDUCTED FOR THE NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION (NHTSA) RECONFIRMS EARLIER FINDINGS THAT ONLY ONE IN FIVE VEHICLE OCCUPANTS USES THE BELT RESTRAINTS AVAILABLE IN THE AUTOMOBILES IN WHICH THEY RIDE. IT WAS CONCLUDED FROM THE SURVEY (INVOLVING MORE THAN 50,000 OBSERVATIONS OF CARS) THAT THE SYSTEM MOST EFFECTIVE IN INDUCING INCREASED USAGE IS THE SO-CALLED "STARTER INTERLOCK SYSTEM" WHICH PREVENTS THE ENGINE FROM STARTING UNLESS SAFETY BELTS ARE PROPERLY FASTENED. HOWEVER, CONGRESS PASSED A LAW PROHIBITING THIS REQUIREMENT. ALSO, PROGRESSIVELY DECREASING USAGE RATES WERE OBSERVED WITH 1975, 1976, AND 1977 MODEL CARS SUGGESTING THAT VEHICLE MANUFACTURERS ARE INSTALLING BELT SYSTEMS WHICH ARE LESS CONVENIENT AND LESS COMFORTABLE TO USE. THIS EXTREMELY LOW RATE OF USAGE IS A PRIMARY REASON TRANSPORTATION SECRETARY BROCK ADAMS MANDATED PASSIVE RESTRAINT SYSTEMS FOR THE FRONT SEATS OF ALL STANDARD-SIZED AND LUXURY-SIZED PASSENGER CARS BEGINNING WITH THE 1982 MODEL YEAR. ALL CARS WOULD BE REQUIRED TO HAVE THIS PROTECTION BY THE 1984 MODEL YEAR. THE DEPT. OF TRANSPORTATION (DOT) FIRMLY BELIEVES THAT AIRBAG-EQUIPPED VEHICLES SHOULD BE INTRODUCED PRIOR TO THE EFFECTIVE DATE OF THE STANDARD AND THAT GOVERNMENT SHOULD SET AN EXAMPLE AND HAVE AIR BAGS INSTALLED IN VEHICLES THEY PURCHASE DURING THE 1980-1981 PERIOD.

by JOAN CLAYBROOK  
NATIONAL HWY. TRAFFIC SAFETY  
ADMINISTRATION, WASHINGTON, D.C. 20590  
1977; 4P  
Availability: DEPARTMENT OF TRANSPORTATION,  
OFFICE OF PUBLIC AFFAIRS, WASHINGTON, D.C.  
20590

## **INDEX to ABSTRACTS**

## KWOC Title Index

### ABSORPTION

DESIGN CONSIDERATIONS IN ENERGY ABSORPTION BY STRUCTURAL COLLAPSE

HS-022 624

ENERGY ABSORPTION BY THE PLASTIC DEFORMATION OF BODY STRUCTURAL MEMBERS

HS-022 622

### ACCELERATION

THE STABILITY OF MOTORCYCLES IN ACCELERATION AND DECELERATION

HS-022 571

### ACCEPTANCE

CONSUMER ACCEPTANCE OF DOWN-SIZED AUTOMOBILES

HS-022 523

### ADDITIVES

THE EFFECT OF GASOLINE ADDITIVES ON FUEL ECONOMY

HS-022 665

### ADHESIVE

THE ADHESIVE TESTING OF HIGH STRENGTH LAMINATES FOR STRUCTURAL DURABILITY

HS-022 678

### ADHESIVES

AUTO ADHESIVES: WHY, HOW, AND WHERE

HS-022 654

### ADJACENT

EFFECT OF BICYCLE LANE USAGE ON VEHICLES IN THE ADJACENT LANE

HS-022 637

### ADJUDICATION

NATIONAL HIGHWAY SAFETY ADVISORY COMMITTEE ON ALCOHOL SAFETY ADJUDICATION. FINAL REPORT

HS-802 510

### ADJUSTED

PARAMETERS FOR THE USE OF DISC BRAKES INCORPORATING AUTOMATICALLY ADJUSTED HANDBRAKE MECHANISMS

HS-022 620

### ADVISORY

HIGHWAY ADVISORY RADIO IN CONSTRUCTION AREAS. FINAL REPORT

HS-022 697

NATIONAL HIGHWAY SAFETY ADVISORY COMMITTEE ON ALCOHOL SAFETY ADJUDICATION. FINAL REPORT

HS-802 510

### AERODYNAMIC

AERODYNAMIC IMPROVEMENTS--A GREAT POTENTIAL FOR BETTER FUEL ECONOMY

HS-022 615

### AERONAUTICS

THE NASA [NATIONAL AERONAUTICS AND SPACE ADMINISTRATION] NASTRAN STRUCTURAL ANALYSIS COMPUTER PROGRAM--NEW CONTENT

HS-022 521

### AFFECTS

HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY

HS-022 517

### AIR

A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR

HS-022 563

AIR BRAKING SYSTEMS FOR COMMERCIAL VEHICLES IN COMPLIANCE WITH THE EEC-DIRECTIVE 71/320 BRAKING

HS-022 602

AIR BRAKING SYSTEMS WITH INCREASED PRESURE

HS-022 598

DESIGN, CONSTRUCTION AND APPLICATION OF AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE] SUSPENSION [BUSES]

HS-022 533

SOME SIGNIFICANT DEVELOPMENTS IN AIR BRAKE SYSTEM COMPONENTS

HS-022 580

WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS FOR STATE, REGIONAL, AND LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

### ALCOHOL

FEASIBILITY OF DETERMINING BLOOD ALCOHOL CONCENTRATIONS IN SOCIAL DRINKING SETTINGS

HS-022 649

NATIONAL HIGHWAY SAFETY ADVISORY COMMITTEE ON ALCOHOL SAFETY ADJUDICATION. FINAL REPORT

HS-802 510

### ALCOHOLISM

FACTOR STRUCTURE OF THE MICHIGAN ALCOHOLISM SCREENING TEST

HS-022 648

### ALERTING

THE COVERT RESPONSES OF DRIVERS TO TWO ROAD BASED ALERTING DEVICES

HS-022 680

THE DEVELOPMENT OF RUMBLE AREAS AS A DRIVER ALERTING DEVICE

HS-022 686

### ALLISON

ALLISON AUTOMATIC TRANSMISSIONS FOR PUBLIC SERVICE VEHICLES [BUSES]

HS-022 538

### ALTERNATIVES

PLANNING FOR THE AUTOMOBILE IN THE SCAG [SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS] REGION. AN EVALUATION OF ALTERNATIVES FOR REDUCING AUTOMOBILE EMISSIONS AND FUEL CONSUMPTION

HS-022 650

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL

**ALTON**  
BEHAVIOUR OF DRIVERS ON YELLOW BAR PAT-  
TERNS - EXPERIMENT ON ALTON BY-PASS,  
HAMPSHIRE

HS-022 679

## **ALUMINUM**

A PRIMER ON FORMING ALUMINUM SHEET

HS-022 655

## **ANALYSES**

INTERIM ANALYSIS OF STR [SHORT TERM REHA-  
BILITATION] PERFORMANCE AND EFFECTIVENESS.  
TWELVE-MONTH ANALYSES

HS-803 285

## **ANALYTICAL**

ANALYTICAL COMPARISON OF INTEGRAL AND  
CHASSIS DESIGN ON BUSES

HS-022 539

## **ANTILOCK**

COMPUTER ANALYSIS OF ANTILOCK SYSTEM PER-  
FORMANCE IN THE BRAKING OF COMMERCIAL  
VEHICLES

HS-022 578

## **ARAMIDS**

ARAMIDS AND POLYIMIDES DIRECT-FORM INTO  
HIGH-PERFORMANCE PLASTICS

HS-022 652

## **ARIZONA**

DEVELOPMENT OF A BICYCLE ACCIDENT RATE IN  
ARIZONA

HS-022 636

## **ART**

TEST AND EVALUATION OF 23 ELECTRIC VEHI-  
CLES FOR STATE-OF-THE-ART ASSESSMENT

HS-022 619

## **ARTICULATED**

ACCIDENTS TO ARTICULATED VEHICLES FITTED  
WITH LOAD SENSING OR ANTI-LOCKING BRAKES  
TO COUNTERACT JACK-KNIFING

HS-022 677

LEGISLATIVE CONTROL OF ARTICULATED VEHI-  
CLE BRAKING [EUROPE]

HS-022 595

## **ASSESSMENT**

AN ASSESSMENT OF THE TECHNOLOGY OF RAN-  
KINE ENGINES FOR AUTOMOBILES

HS-022 647

NECK INJURY ASSESSMENT PROTOCOL. FINAL RE-  
PORT

HS-803 287

TEST AND EVALUATION OF 23 ELECTRIC VEHI-  
CLES FOR STATE-OF-THE-ART ASSESSMENT

HS-022 619

PORT ENGINEERS, LOUGHBOROUGH UNIVER-  
OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-02

PLANNING FOR THE AUTOMOBILE IN THE S  
[SOUTHERN CALIFORNIA ASSOCIATION  
GOVERNMENTS] REGION. AN EVALUATION OF  
TERNATIVES FOR REDUCING AUTOMOBILE E  
SIONS AND FUEL CONSUMPTION

HS-02

## **ATTITUDES**

A STUDY OF MALE MOTORISTS' ATTITUDES  
SPEED RESTRICTIONS AND THEIR ENFORCEMENT

HS-022

## **AUTO**

AUTO ADHESIVES: WHY, HOW, AND WHERE

HS-022

## **AUTOKUT**

BUS RESEARCH AND DEVELOPMENT AT AUTOK  
RESEARCH INSTITUTE, HUNGARY

HS-022

## **AUTOMATIC**

ALLISON AUTOMATIC TRANSMISSIONS F  
PUBLIC SERVICE VEHICLES [BUSES]

HS-022

## **AUTOMATICALLY**

PARAMETERS FOR THE USE OF DISC BRAKES I  
CORPORATING AUTOMATICALLY ADJUSTED HAN  
BRAKE MECHANISMS

HS-022 6

## **AUTOMOBILE**

BRAKING OF ROAD VEHICLES. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHAN-  
CAL ENGINEERS, AUTOMOBILE DIVISION, IN A  
SOCIATION WITH THE INSTITUTE OF ROAD TRAN-  
SPORT ENGINEERS, LOUGHBOROUGH UNIVERSIT  
OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 51

DYNAMIC SIMULATION OF AN AUTOMOBILE BOD  
UTILIZING FINITE ELEMENT AND MODAL SYNTHI-  
SIS TECHNIQUES

HS-022 62

PLANNING FOR THE AUTOMOBILE IN THE SCA  
[SOUTHERN CALIFORNIA ASSOCIATION O.  
GOVERNMENTS] REGION. AN EVALUATION OF AL-  
TERNATIVES FOR REDUCING AUTOMOBILE EMIS-  
SIONS AND FUEL CONSUMPTION

HS-022 651

TARGET IDENTIFICATION CAPABILITY OF SWEP  
FREQUENCY AUTOMOBILE RADAR

HS-022 613

THE COMPLETE BOOK OF AUTOMOBILE BODY  
DESIGN

HS-022 695

THE DESIGN, CONSTRUCTION AND OPERATION OF  
PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHAN-



August 31, 1978

CAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL  
OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977

HS-022 527

## **AUTOMOBILES**

AN ASSESSMENT OF THE TECHNOLOGY OF RAN-  
KINE ENGINES FOR AUTOMOBILES

HS-022 647

COLLISION AVOIDANCE SYSTEM FOR AUTOMO-  
BILES

HS-022 614

CONSUMER ACCEPTANCE OF DOWN-SIZED AU-  
TOMOBILES

HS-022 523

## **AUTOMOTIVE**

A WORLDWIDE OVERVIEW OF AUTOMOTIVE EN-  
GINE CONTROL SENSOR TECHNOLOGY

HS-022 558

ALTERNATIVE FUELS FOR AUTOMOTIVE TRANS-  
PORTATION -A FEASIBILITY STUDY. VOL. 2--  
TECHNICAL SECTION

HS-022 644

ALTERNATIVE FUELS FOR AUTOMOTIVE TRANS-  
PORTATION--A FEASIBILITY STUDY. VOL. 1--EX-  
ECUTIVE SUMMARY

HS-022 643

APPLICATION OF AUTOMOTIVE SENSORS TO EN-  
GINE CONTROL

HS-022 561

ARE PEOPLE STILL GETTING BIGGER--WHO,  
WHERE, AND HOW MUCH? [DESIGN OF AUTOMO-  
TIVE EQUIPMENT]

HS-022 616

AUTOMOTIVE APPLICATIONS OF SENSORS

HS-022 557

AUTOMOTIVE FLEET FUEL CONSUMPTION MODEL:  
FUEL FOR FINAL REPORT

HS-803 223

ECONOMIC COMPARISON OF FUTURE AUTOMO-  
TIVE POWER SYSTEMS

HS-022 518

FEASIBILITY TEST ON COMPOUNDING THE INTER-  
NAL COMBUSTION ENGINE FOR AUTOMOTIVE  
VEHICLES, TASK 2. FINAL REPORT

HS-022 646

IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMO-  
TIVE FUEL ECONOMY AND EMISSIONS

HS-022 515

PRECISION POSITION-SENSORS IN AUTOMOTIVE  
APPLICATIONS

HS-022 560

RELIABILITY, MAINTAINABILITY, SAFETY AND  
HUMAN FACTOR (RMSH) CONSIDERATIONS IN THE  
AUTOMOTIVE INDUSTRY

HS-022 519

THE DESIGN, CONSTRUCTION AND OPERATION OF  
PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIV., AND SCHOOL  
OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977

HS-022 527

THE FIRST PRODUCTION AUTOMOTIVE CAPACI-  
TIVE PRESSURE SENSOR

HS-022 565

THE WIEGAND EFFECT AND ITS AUTOMOTIVE AP-  
PLICATIONS

HS-022 559

## **AVOIDANCE**

COLLISION AVOIDANCE SYSTEM FOR AUTOMO-  
BILES

HS-022 614

SKILL TRAINING FOR COLLISION AVOIDANCE

HS-022 640

## **AWARE**

'AWARE,' AN IN-VEHICLE VISUAL COMMUNICA-  
TION SYSTEM FOR DRIVERS

HS-022 685

## **BAR**

BEHAVIOUR OF DRIVERS ON YELLOW BAR PAT-  
TERNS - EXPERIMENT ON ALTON BY-PASS,  
HAMPSHIRE

HS-022 679

## **BASE**

ACCIDENT DATA BASE FOR URBAN PEDESTRIANS

HS-022 632

## **BEAM**

A DATA RECORDING SYSTEM OF THE PATH OF A  
TEST VEHICLE BY LASER BEAM AND SOME APPLI-  
CATIONS TO STEERING HANDLING TEST

HS-022 520

EVALUATION OF MEETING BEAMS OF TWO- AND  
THREE-BEAM HEADLIGHTING SYSTEMS

HS-022 700

THE RELATIVE MERITS OF DIFFERENT LOW BEAM  
HEADLIGHTING SYSTEMS - A REVIEW OF THE  
LITERATURE. FINAL REPORT

HS-022 704

## **BEAMS**

EVALUATION OF MEETING BEAMS OF TWO- AND  
THREE-BEAM HEADLIGHTING SYSTEMS

HS-022 700

## **BEHAVIOUR**

BEHAVIOUR OF DRIVERS ON YELLOW BAR PAT-  
TERNS - EXPERIMENT ON ALTON BY-PASS,  
HAMPSHIRE

HS-022 679

## **BELT**

A COMPARISON OF ADVANCED BELT SYSTEMS RE-  
GARDING THEIR EFFECTIVENESS

HS-022 623

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE  
BOLSTER RESTRAINT, VWRA--A PRELIMINARY  
FIELD PERFORMANCE EVALUATION--PROGRESS  
REPORT

HS-022 625

## **BICYCLE**

BICYCLE TRANSPORTATION FOR DOWNTOWN  
WORK TRIPS: A CASE STUDY IN DAVIS, CALIFOR-  
NIA

HS-022 633

DEVELOPMENT OF A BICYCLE ACCIDENT RATE IN ARIZONA

HS-022 636

EFFECT OF BICYCLE LANE USAGE ON VEHICLES IN THE ADJACENT LANE

HS-022 637

EVALUATING THE IMPACT OF WEATHER ON BICYCLE USE

HS-022 635

PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY

HS-022 626

## BIGGER

ARE PEOPLE STILL GETTING BIGGER--WHO, WHERE, AND HOW MUCH? [DESIGN OF AUTOMOTIVE EQUIPMENT]

HS-022 616

## BIKEWAYS

CITIZEN PARTICIPATION IN PLANNING AND DESIGNING BIKEWAYS

HS-022 634

## BIOSCIENCES

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM

HS-022 701

## BLOOD

FEASIBILITY OF DETERMINING BLOOD ALCOHOL CONCENTRATIONS IN SOCIAL DRINKING SETTINGS

HS-022 649

## BODY

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS TECHNIQUES

HS-022 621

ENERGY ABSORPTION BY THE PLASTIC DEFORMATION OF BODY STRUCTURAL MEMBERS

HS-022 622

THE COMPLETE BOOK OF AUTOMOBILE BODY DESIGN

HS-022 695

## BOLSTER

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT

HS-022 625

## BOOK

THE COMPLETE BOOK OF AUTOMOBILE BODY DESIGN

HS-022 695

## BOOKS

A CONTENT ANALYSIS OF FIVE BOOKS ON DRIVING

HS-022 688

## BRAKE

A THEORY OF DRUM BRAKE SQUEAL

HS-022 585

BRAKE DEFECTS IN CARS

HS-022 591

BRAKE PERFORMANCE AND COSTS--COMMERCIAL VEHICLES

HS-022 601

CAST IRON BRAKE ROTOR METALLURGY

HS-022 581

DISC BRAKE SQUEAL

HS-022 584

EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS

HS-022 577

IMPLICATIONS OF SOME CHARACTERISTICS OF DRIVERS FOR BRAKE SYSTEM PERFORMANCE

HS-022 586

SOME SIGNIFICANT DEVELOPMENTS IN AIR BRAKE SYSTEM COMPONENTS

HS-022 580

THE EFFECT OF SURGICAL OPERATION ON THE 'BRAKE-CLUTCH SIMULATOR'

HS-022 589

## BRAKES

A REVIEW OF COMMERCIAL VEHICLE BRAKES

HS-022 599

ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING

HS-022 677

BRAKES--A REVIEW OF EXISTING DESIGN

HS-022 582

DISC BRAKES FOR COMMERCIAL VEHICLES

HS-022 600

OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES

HS-022 590

PARAMETERS FOR THE USE OF DISC BRAKES INCORPORATING AUTOMATICALLY ADJUSTED HAND-BRAKE MECHANISMS

HS-022 620

THEORY OF RELIABILITY AND ITS APPLICATION TO VEHICLE BRAKES AND BRAKING SYSTEMS

HS-022 593

## BRAKING

ACCIDENTS INVOLVING LOSS OF CONTROL WHEN BRAKING - A STUDY OF THE ON-THE-SPOT SURVEY DATA

HS-022 588

AIR BRAKING SYSTEMS FOR COMMERCIAL VEHICLES IN COMPLIANCE WITH THE EEC-DIRECTIVE 71/320 BRAKING

HS-022 602

AIR BRAKING SYSTEMS WITH INCREASED PRESURE

HS-022 598

BASIC PRINCIPLES [VEHICLE BRAKING]

HS-022 567

BRAKING BUSES

HS-022 537

August 31, 1978

BRAKING OF ROAD VEHICLES. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIVISION, IN AS-  
OCIATION WITH THE INSTITUTE OF ROAD TRANS-  
PORT ENGINEERS, LOUGHBOROUGH UNIVERSITY  
OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

BRAKING REGULATIONS IN EUROPE

HS-022 596

BRAKING SYSTEMS FOR RIGID VEHICLES

HS-022 568

COMPUTER ANALYSIS OF ANTILOCK SYSTEM PER-  
FORMANCE IN THE BRAKING OF COMMERCIAL  
VEHICLES

HS-022 578

DEFECTS IN ROAD VEHICLE BRAKING SYSTEMS--  
EXPERIENCE FROM STATUTORY INSPECTIONS

HS-022 592

EVALUATION OF THE BRAKING PERFORMANCE OF  
'PASSENGER CARS WITH FIXED AND WITH  
KINKED' BRAKE-FORCE DISTRIBUTIONS

HS-022 577

LATERAL STABILITY OF COMMERCIAL ROAD VEHI-  
CLE TRAINS UNDER BRAKING CONDITIONS

HS-022 570

LEGISLATIVE CONTROL OF ARTICULATED VEHI-  
CLE BRAKING [EUROPE]

HS-022 595

NON-RIGID VEHICLE BRAKING SYSTEMS

HS-022 569

RECENT PROGRESS IN BRAKING TESTS BY USE OF  
A CAR DYNAMOMETER

HS-022 583

RELIABILITY AND MAINTAINABILITY OF BRAKING  
SYSTEMS--MILITARY APPLICATIONS

HS-022 594

REVIEW OF BRAKING LEGISLATION IN BRITAIN  
DURING THE PAST DECADE

HS-022 597

THE DYNAMICS OF WHEEL BRAKING

HS-022 572

THE INFLUENCE OF WHEEL SLIP CONTROL  
DYNAMICS ON VEHICLE STABILITY DURING BRAK-  
ING AND STEERING

HS-022 573

THE TYRE/ROAD [TIRE/ROAD] INTERFACE--ITS EF-  
FECT ON BRAKING

HS-022 574

THEORY OF RELIABILITY AND ITS APPLICATION  
TO VEHICLE BRAKES AND BRAKING SYSTEMS

HS-022 593

WET FRICTION--TYRE [TIRE] AND ROAD [BRAKING]

HS-022 575

## BREATH

EVALUATION OF SCREENING BREATH TESTING IN  
TRAFFIC LAW ENFORCEMENT. FINAL REPORT

HS-803 274

## BRITAIN

REVIEW OF BRAKING LEGISLATION IN BRITAIN  
DURING THE PAST DECADE

HS-022 597

## BUS

BUS RESEARCH AND DEVELOPMENT AT AUTOKUT  
RESEARCH INSTITUTE, HUNGARY

HS-022 540

NEW STANDARD BUS EQUIPMENT

HS-022 555

PROSPECTS FOR BUS AND COACH TRANSPORT  
[UNITED KINGDOM]

HS-022 528

PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS]  
OCCUPANTS IN FRONTAL IMPACTS

HS-022 546

THE EFFECT OF HYDROPLANING ON THE DYNAM-  
IC CHARACTERISTICS OF CAR, TRUCK AND BUS  
TIRES

HS-022 608

## BUSES

A DESIGN AND EVALUATION STUDY OF HAND-  
HOLDS AND FOOTHOLDS FOR EMERGENCY WIN-  
DOWS OF CLASS III PUBLIC SERVICE VEHICLES  
[BUSES]

HS-022 529

ALLISON AUTOMATIC TRANSMISSIONS FOR  
PUBLIC SERVICE VEHICLES [BUSES]

HS-022 538

ANALYTICAL COMPARISON OF INTEGRAL AND  
CHASSIS DESIGN ON BUSES

HS-022 539

BRAKING BUSES

HS-022 537

DESIGN, CONSTRUCTION AND APPLICATION OF  
AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE]  
SUSPENSION [BUSES]

HS-022 533

ENVIRONMENTAL REQUIREMENTS FOR PSV  
[PUBLIC SERVICE VEHICLE] OPERATION [BUSES]

HS-022 530

HEATING AND VENTILATING [OF BUSES] IN U.K.  
[UNITED KINGDOM]

HS-022 532

HYDRAULIC SUSPENSIONS WITH PARTICULAR  
REFERENCE TO PUBLIC SERVICE VEHICLES  
[BUSES]

HS-022 534

INVESTIGATION OF PSV [PUBLIC SERVICE VEHI-  
CLE] ROLL OVER SAFETY [BUSES]

HS-022 535

POWER TRAIN ENGINEERING FOR PUBLIC SERVICE  
VEHICLES [BUSES]

HS-022 545

STATUTORY TECHNICAL CONTROL OF PUBLIC  
SERVICE VEHICLES [BUSES] [UNITED KINGDOM]

HS-022 531

THE CHOICE OF MATERIALS IN THE DESIGN AND  
CONSTRUCTION OF PUBLIC SERVICE VEHICLES  
[BUSES]

HS-022 541

THE DESIGN, CONSTRUCTION AND OPERATION OF  
PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIV., AND SCHOOL

OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977

HS-022 527

THE NATIONAL PSV [PUBLIC SERVICE VEHICLE]  
ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED  
STUDY [BUSES]

HS-022 544

THE OPERATORS' PERFORMANCE REQUIREMENTS  
FOR POWER UNITS AND TRANSMISSION SYSTEMS  
FOR PUBLIC SERVICE VEHICLES [BUSES] IN  
URBAN OPERATION

HS-022 542

VEHICLE TYPES IN RELATION TO SPECIFIC  
OPERATING CONDITIONS [UNITED KINGDOM]  
[BUSES]

HS-022 536

## BUSINESS

A METHOD FOR ESTIMATING PEDESTRIAN  
VOLUME IN A CENTRAL BUSINESS DISTRICT

HS-022 631

## CABS

TOXIC GASES IN HEAVY DUTY DIESEL TRUCK  
CABS. FINAL REPORT

HS-022 696

WHAT'S NEW WITH COE'S [CABS-OVER-ENGINES]

HS-022 651

## CALIFORNIA

A REANALYSIS OF CALIFORNIA DRIVER VISION  
DATA: GENERAL FINDINGS

HS-022 675

BICYCLE TRANSPORTATION FOR DOWNTOWN  
WORK TRIPS: A CASE STUDY IN DAVIS, CALIFOR-  
NIA

HS-022 633

MEASURING THE OUTCOMES OF DRIVER TRAIN-  
ING: UNIVERSITY OF SOUTHERN CALIFORNIA  
DRIVER PERFORMANCE TEST

HS-022 639

PLANNING FOR THE AUTOMOBILE IN THE SCAG  
[SOUTHERN CALIFORNIA ASSOCIATION OF  
GOVERNMENTS] REGION. AN EVALUATION OF AL-  
TERNATIVES FOR REDUCING AUTOMOBILE EMIS-  
SIONS AND FUEL CONSUMPTION

HS-022 650

## CALIFORNIANS

CALIFORNIANS LEAD THE WAY IN DEVELOPMENT  
OF ELECTRIC CARS

HS-022 699

## CAPABILITY

TARGET IDENTIFICATION CAPABILITY OF SWEEPED  
FREQUENCY AUTOMOBILE RADAR

HS-022 613

## CAPACITIVE

THE FIRST PRODUCTION AUTOMOTIVE CAPACI-  
TIVE PRESSURE SENSOR

HS-022 565

## CAR

AN OVERALL DESIGN APPROACH TO IMPROVING  
PASSENGER CAR FUEL ECONOMY

HS-022 605

HOW PASSENGER CAR MAINTENANCE AFFECTS  
FUEL ECONOMY AND EMISSIONS. A NATIONWIDE  
SURVEY

HS-022 517

MALE AND FEMALE CAR DRIVERS: DIFFERENCES  
OBSERVED IN ACCIDENTS

HS-022 674

RECENT PROGRESS IN BRAKING TESTS BY USE OF  
A CAR DYNAMOMETER

HS-022 583

THE EFFECT OF HYDROPLANING ON THE DYNAM-  
IC CHARACTERISTICS OF CAR, TRUCK AND BUS  
TIRES

HS-022 608

THE SOCIALLY RESPONSIBLE CAR

HS-022 526

THE TARGET CAR PROGRAM FOR 1977

HS-022 603

## CARS

ANTI-CORROSIVE PROTECTION OF CARS

HS-022 660

BASIC REQUIREMENTS FOR URBAN CARS

HS-022 610

BRAKE DEFECTS IN CARS

HS-022 591

CALIFORNIANS LEAD THE WAY IN DEVELOPMENT  
OF ELECTRIC CARS

HS-022 699

EVALUATION OF THE BRAKING PERFORMANCE OF  
PASSENGER CARS WITH FIXED AND WITH  
'KINKED' BRAKE-FORCE DISTRIBUTIONS

HS-022 577

PASSIVE VEHICLE SAFETY AS CARS GROW  
SMALLER

HS-022 617

## CASE

BICYCLE TRANSPORTATION FOR DOWNTOWN  
WORK TRIPS: A CASE STUDY IN DAVIS, CALIFOR-  
NIA

HS-022 633

## CAST

CAST IRON BRAKE ROTOR METALLURGY

HS-022 581

## CAUSE

ROAD ACCIDENTS AS A CAUSE OF DEATH IN  
DEVELOPING COUNTRIES

HS-022 683

## CENTRAL

A METHOD FOR ESTIMATING PEDESTRIAN  
VOLUME IN A CENTRAL BUSINESS DISTRICT

HS-022 631

## CHALLENGES

THE 1980'S: CHALLENGES OF CHANGE CONFRONT-  
ING THE MOTOR VEHICLE AND FREEDOM OF MO-  
BILITY

HS-022 547

## CHARACTERISTICS

IMPLICATIONS OF SOME CHARACTERISTICS OF  
DRIVERS FOR BRAKE SYSTEM PERFORMANCE

HS-022 586

18 August 31, 1978

THE EFFECT OF HYDROPLANING ON THE DYNAMIC CHARACTERISTICS OF CAR, TRUCK AND BUS TIRES

HS-022 608

THE EFFECT OF VEHICLE AND ROAD CHARACTERISTICS ON COMMERCIAL VEHICLE SPEEDS IN ETHIOPIA

HS-022 681

### CHASSIS

ANALYTICAL COMPARISON OF INTEGRAL AND CHASSIS DESIGN ON BUSES

HS-022 539

### CHILDREN

SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT STUDY AMONGST CHILDREN

HS-022 684

### CHOICE

THE CHOICE OF MATERIALS IN THE DESIGN AND CONSTRUCTION OF PUBLIC SERVICE VEHICLES [BUSES]

HS-022 541

### CINERADIOGRAPHIC

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM

HS-022 701

### CITIZEN

CITIZEN PARTICIPATION IN PLANNING AND DESIGNING BIKEWAYS

HS-022 634

### CLASS

A DESIGN AND EVALUATION STUDY OF HANDHOLDS AND FOOTHOLDS FOR EMERGENCY WINDOWS OF CLASS III PUBLIC SERVICE VEHICLES [BUSES]

HS-022 529

### CLUB

STATEMENT AT THE NATIONAL PRESS CLUB, WASHINGTON, D.C., THURSDAY, SEPT. 1, 1977

HS-810 314

### CLUTCH

THE EFFECT OF SURGICAL OPERATION ON THE 'BRAKE-CLUTCH SIMULATOR'

HS-022 589

### COACH

PROSPECTS FOR BUS AND COACH TRANSPORT [UNITED KINGDOM]

HS-022 528

### COE

WHAT'S NEW WITH COE'S [CABS-OVER-ENGINES]

HS-022 651

### COLLAPSE

DESIGN CONSIDERATIONS IN ENERGY ABSORPTION BY STRUCTURAL COLLAPSE

HS-022 624

### COLLISION

COLLISION AVOIDANCE SYSTEM FOR AUTOMOBILES

HS-022 614

SKILL TRAINING FOR COLLISION AVOIDANCE

HS-022 640

### COMBUSTION

FEASIBILITY TEST ON COMPOUNDING THE INTERNAL COMBUSTION ENGINE FOR AUTOMOTIVE VEHICLES, TASK 2. FINAL REPORT

HS-022 646

### COMMERCIAL

A REVIEW OF COMMERCIAL VEHICLE BRAKES

HS-022 599

AIR BRAKING SYSTEMS FOR COMMERCIAL VEHICLES IN COMPLIANCE WITH THE EEC-DIRECTIVE 71/320 BRAKING

HS-022 602

BRAKE PERFORMANCE AND COSTS--COMMERCIAL VEHICLES

HS-022 601

COMPUTER ANALYSIS OF ANTILOCK SYSTEM PERFORMANCE IN THE BRAKING OF COMMERCIAL VEHICLES

HS-022 578

DISC BRAKES FOR COMMERCIAL VEHICLES

HS-022 600

LATERAL STABILITY OF COMMERCIAL ROAD VEHICLE TRAINS UNDER BRAKING CONDITIONS

HS-022 570

PRACTICAL ASPECTS OF TESTING ANTI-LOCK SYSTEMS ON COMMERCIAL VEHICLES

HS-022 579

THE EFFECT OF VEHICLE AND ROAD CHARACTERISTICS ON COMMERCIAL VEHICLE SPEEDS IN ETHIOPIA

HS-022 681

### COMMITTEE

NATIONAL HIGHWAY SAFETY ADVISORY COMMITTEE ON ALCOHOL SAFETY ADJUDICATION. FINAL REPORT

HS-802 510

### COMMUNICATION

'AWARE,' AN IN-VEHICLE VISUAL COMMUNICATION SYSTEM FOR DRIVERS

HS-022 685

### COMPARISON

A COMPARISON OF ADVANCED BELT SYSTEMS REGARDING THEIR EFFECTIVENESS

HS-022 623

ANALYTICAL COMPARISON OF INTEGRAL AND CHASSIS DESIGN ON BUSES

HS-022 539

ECONOMIC COMPARISON OF FUTURE AUTOMOTIVE POWER SYSTEMS

HS-022 518

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE

AND RELAY DEVICES AND TECHNIQUES. FINAL REPORT

HS-022 692

## COMPARISONS

ENERGY USE AND OTHER COMPARISONS BETWEEN DIESEL AND GASOLINE PICKUP TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977

HS-022 548

## COMPILATION

COMPILATION OF REPORTS GENERATED BY THE TIRE SYSTEMS DIVISION, SAFETY RESEARCH LABORATORY, 1967 THRU JANUARY 1978. PRELIMINARY REPORT

HS-803 312

## COMPLETING

THE 1979 ESTIMATE OF THE COST OF COMPLETING THE INTERSTATE SYSTEM. INSTRUCTION MANUAL FOR PREPARATION AND SUBMISSION

HS-022 553

## COMPLIANCE

AIR BRAKING SYSTEMS FOR COMMERCIAL VEHICLES IN COMPLIANCE WITH THE EEC-DIRECTIVE 71/320 BRAKING

HS-022 602

## COMPONENTS

SOME SIGNIFICANT DEVELOPMENTS IN AIR BRAKE SYSTEM COMPONENTS

HS-022 580

## COMPOUNDING

FEASIBILITY TEST ON COMPOUNDING THE INTERNAL COMBUSTION ENGINE FOR AUTOMOTIVE VEHICLES, TASK 2. FINAL REPORT

HS-022 646

## COMPOUNDS

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OCTOBER TO 31 OCTOBER 1977

HS-803 313

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 9, 1 NOVEMBER TO 30 NOVEMBER 1977

HS-803 318

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 10, 1 DECEMBER TO 31 DECEMBER 1977

HS-803 319

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978

HS-803 320

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978

HS-803 321

## COMPREHENSIVE

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2: COMPREHENSIVE TECHNICAL RESULTS. FINAL REPORT

HS-803 250

## COMPRESSION

MOTOR GASOLINE AND THE EFFECT OF COMPRESSION RATIO ON OCTANE REQUIREMENT AND FUEL ECONOMY

HS-022 663

## COMPUTER

COMPUTER ANALYSIS OF ANTILOCK SYSTEM PERFORMANCE IN THE BRAKING OF COMMERCIAL VEHICLES

HS-022 578

THE NASA [NATIONAL AERONAUTICS AND SPACE ADMINISTRATION] NASTRAN STRUCTURAL ANALYSIS COMPUTER PROGRAM--NEW CONTENT

HS-022 521

USING COMPUTER SIMULATION TO EVALUATE AND IMPROVE VEHICLE HANDLING

HS-022 513

## CONCENTRATIONS

FEASIBILITY OF DETERMINING BLOOD ALCOHOL CONCENTRATIONS IN SOCIAL DRINKING SETTINGS

HS-022 649

## CONFERENCE

BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977

HS-022 527

## CONFIRM

TESTS CONFIRM FORMABILITY OF DUAL-PHASE, HIGH-STRENGTH STEEL SHEET

HS-022 653

## CONFRONTING

THE 1980'S: CHALLENGES OF CHANGE CONFRONTING THE MOTOR VEHICLE AND FREEDOM OF MOBILITY

HS-022 547

## CONSTRUCTION

DESIGN, CONSTRUCTION AND APPLICATION OF AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE] SUSPENSION [BUSES]

HS-022 533

HIGHWAY ADVISORY RADIO IN CONSTRUCTION AREAS. FINAL REPORT

HS-022 697

August 31, 1978

THE CHOICE OF MATERIALS IN THE DESIGN AND CONSTRUCTION OF PUBLIC SERVICE VEHICLES [BUSES]

HS-022 541

THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977

HS-022 527

## CONTENT

A CONTENT ANALYSIS OF FIVE BOOKS ON DRIVING

HS-022 688

THE NASA [NATIONAL AERONAUTICS AND SPACE ADMINISTRATION] NASTRAN STRUCTURAL ANALYSIS COMPUTER PROGRAM--NEW CONTENT

HS-022 521

## CONTROL

A WORLDWIDE OVERVIEW OF AUTOMOTIVE ENGINE CONTROL SENSOR TECHNOLOGY

HS-022 558

ACCIDENTS INVOLVING LOSS OF CONTROL WHEN BRAKING - A STUDY OF THE ON-THE-SPOT SURVEY DATA

HS-022 588

APPLICATION OF A CRANKSHAFT POSITION SENSOR TO CONTROL ENGINE TIMING

HS-022 564

APPLICATION OF AUTOMOTIVE SENSORS TO ENGINE CONTROL

HS-022 561

LEGISLATIVE CONTROL OF ARTICULATED VEHICLE BRAKING [EUROPE]

HS-022 595

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT

HS-022 691

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE AND RELAY DEVICES AND TECHNIQUES. FINAL REPORT

HS-022 692

STATUTORY TECHNICAL CONTROL OF PUBLIC SERVICE VEHICLES [BUSES] [UNITED KINGDOM]

HS-022 531

TEMPERATURE SENSORS FOR ELECTRONIC ENGINE CONTROL SYSTEMS

HS-022 562

THE INFLUENCE OF WHEEL SLIP CONTROL DYNAMICS ON VEHICLE STABILITY DURING BRAKING AND STEERING

HS-022 573

## CONTROLS

PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY

HS-022 626

THE EFFECT OF EMISSION CONTROLS ON FUEL ECONOMY

HS-022 668

## CORNERING

DYNAMIC CORNERING PROPERTIES OF TIRES

HS-022 607

## CORROSIVE

ANTI-CORROSIVE PROTECTION OF CARS

HS-022 660

## COST

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST OF ELECTRIC VEHICLES

HS-022 611

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT

HS-022 691

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE AND RELAY DEVICES AND TECHNIQUES. FINAL REPORT

HS-022 692

THE 1979 ESTIMATE OF THE COST OF COMPLETING THE INTERSTATE SYSTEM. INSTRUCTION MANUAL FOR PREPARATION AND SUBMISSION

HS-022 553

## COSTS

BRAKE PERFORMANCE AND COSTS--COMMERCIAL VEHICLES

HS-022 601

## COUNTERACT

ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING

HS-022 677

## COUNTRIES

A STUDY OF ROAD ACCIDENTS IN SELECTED URBAN AREAS IN DEVELOPING COUNTRIES

HS-022 676

ROAD ACCIDENTS AS A CAUSE OF DEATH IN DEVELOPING COUNTRIES

HS-022 683

## COURSE

AN EXPERIMENTAL STUDY OF THE DEFENSIVE DRIVING COURSE

HS-022 638

## COVERT

THE COVERT RESPONSES OF DRIVERS TO TWO ROAD BASED ALERTING DEVICES

HS-022 680

## CRANFIELD

THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL



- OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977  
HS-022 527
- CRANKCASE**  
THE EFFECT OF CRANKCASE LUBRICANTS ON  
FUEL ECONOMY  
HS-022 670
- CRANKSHAFT**  
APPLICATION OF A CRANKSHAFT POSITION SEN-  
SOR TO CONTROL ENGINE TIMING  
HS-022 564
- CRASH**  
CRASH SAFETY FOR RAILROAD PASSENGERS,  
TRAIN CREWS AND GRADE CROSSING CRASH VIC-  
TIMS  
HS-022 514
- CREWS**  
CRASH SAFETY FOR RAILROAD PASSENGERS,  
TRAIN CREWS AND GRADE CROSSING CRASH VIC-  
TIMS  
HS-022 514
- CROSSING**  
CRASH SAFETY FOR RAILROAD PASSENGERS,  
TRAIN CREWS AND GRADE CROSSING CRASH VIC-  
TIMS  
HS-022 514
- POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY  
SURVEY AND RELAY ALTERNATIVES. FINAL RE-  
PORT  
HS-022 691
- POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE  
AND RELAY DEVICES AND TECHNIQUES. FINAL  
REPORT  
HS-022 692
- CYBERMAN**  
CYBERMAN--A HUMAN FACTORS DESIGN TOOL  
HS-022 618
- CYCLISTS**  
SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT  
STUDY AMONGST CHILDREN  
HS-022 684
- DAVIS**  
BICYCLE TRANSPORTATION FOR DOWNTOWN  
WORK TRIPS: A CASE STUDY IN DAVIS, CALIFOR-  
NIA  
HS-022 633
- DEATH**  
DEATH AND INJURY ROAD ACCIDENTS IN  
NORTHERN IRELAND 1976  
HS-022 693
- ROAD ACCIDENTS AS A CAUSE OF DEATH IN  
DEVELOPING COUNTRIES  
HS-022 683
- DECADE**  
REVIEW OF BRAKING LEGISLATION IN BRITAIN  
DURING THE PAST DECADE  
HS-022 597
- DECELERATION**  
THE STABILITY OF MOTORCYCLES IN ACCELE-  
RATION AND DECELERATION  
HS-022 571
- DEFECTS**  
BRAKE DEFECTS IN CARS  
HS-022 591
- DEFECTS IN ROAD VEHICLE BRAKING SYSTEMS--  
EXPERIENCE FROM STATUTORY INSPECTIONS  
HS-022 592
- DEFENSIVE**  
AN EXPERIMENTAL STUDY OF THE DEFENSIVE  
DRIVING COURSE  
HS-022 638
- DEFORMATION**  
ENERGY ABSORPTION BY THE PLASTIC DEFORMA-  
TION OF BODY STRUCTURAL MEMBERS  
HS-022 622
- DEFORMATIONS**  
PLASTIC DEFORMATIONS AND ENERGY CONSUMP-  
TION AT DYNAMIC (IMPACT) LOADS  
HS-022 543
- DELAY**  
PEDESTRIAN DELAY AND PEDESTRIAN SIGNAL  
WARRANTS  
HS-022 628
- DESIGN**  
A DESIGN AND EVALUATION STUDY OF HAND-  
HOLDS AND FOOHOLDS FOR EMERGENCY WIN-  
DOWS OF CLASS III PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 529
- AN OVERALL DESIGN APPROACH TO IMPROVING  
PASSENGER CAR FUEL ECONOMY  
HS-022 605
- ANALYTICAL COMPARISON OF INTEGRAL AND  
CHASSIS DESIGN ON BUSES  
HS-022 539
- ARE PEOPLE STILL GETTING BIGGER--WHO,  
WHERE, AND HOW MUCH? [DESIGN OF AUTOMO-  
TIVE EQUIPMENT]  
HS-022 616
- BRAKES--A REVIEW OF EXISTING DESIGN  
HS-022 582
- CYBERMAN--A HUMAN FACTORS DESIGN TOOL  
HS-022 618
- DESIGN CONSIDERATIONS IN ENERGY ABSORP-  
TION BY STRUCTURAL COLLAPSE  
HS-022 624
- DESIGN INNOVATIONS FACILITATING ECONOMIC  
PRODUCTION OF GIANT MOULDINGS  
HS-022 552
- DESIGN, CONSTRUCTION AND APPLICATION OF  
AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE]  
SUSPENSION [BUSES]  
HS-022 533

August 31, 1978

- ENGINE DESIGN SERIES: FUEL SYSTEMS--DIESEL  
HS-022 659
- THE CHOICE OF MATERIALS IN THE DESIGN AND  
CONSTRUCTION OF PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 541
- THE COMPLETE BOOK OF AUTOMOBILE BODY  
DESIGN  
HS-022 695
- THE DESIGN, CONSTRUCTION AND OPERATION OF  
PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIV., AND SCHOOL  
OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977  
HS-022 527
- THE NATIONAL PSV [PUBLIC SERVICE VEHICLE]  
ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED  
STUDY [BUSES]  
HS-022 544
- DESIGNING**  
CITIZEN PARTICIPATION IN PLANNING AND DESIGNING  
BIKEWAYS  
HS-022 634
- DESIGNS**  
NEW DESIGNS THROUGH VIBRATION WELDING  
HS-022 687
- DETECTORS**  
A STATUS REPORT ON VEHICLE DETECTORS.  
FINAL REPORT  
HS-022 698
- DEVELOPING**  
A STUDY OF ROAD ACCIDENTS IN SELECTED  
URBAN AREAS IN DEVELOPING COUNTRIES  
HS-022 676
- ROAD ACCIDENTS AS A CAUSE OF DEATH IN  
DEVELOPING COUNTRIES  
HS-022 683
- DEVELOPMENTS**  
SOME SIGNIFICANT DEVELOPMENTS IN AIR  
BRAKE SYSTEM COMPONENTS  
HS-022 580
- DEVICE**  
THE DEVELOPMENT OF RUMBLE AREAS AS A  
DRIVER ALERTING DEVICE  
HS-022 686
- DEVICES**  
POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE  
AND RELAY DEVICES AND TECHNIQUES. FINAL  
REPORT  
HS-022 692
- THE COVERT RESPONSES OF DRIVERS TO TWO  
ROAD BASED ALERTING DEVICES  
HS-022 680
- DIAGNOSTIC**  
IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMOTIVE  
FUEL ECONOMY AND EMISSIONS  
HS-022 515
- REPAIR INDUSTRY RESPONSE TO DIAGNOSTIC INSPECTION  
PROJECTS  
HS-022 516
- DIESEL**  
ENERGY USE AND OTHER COMPARISONS  
BETWEEN DIESEL AND GASOLINE PICKUP  
TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977  
HS-022 548
- ENGINE DESIGN SERIES: FUEL SYSTEMS--DIESEL  
HS-022 659
- TOXIC GASES IN HEAVY DUTY DIESEL TRUCK  
CABS. FINAL REPORT  
HS-022 696
- DIFFERENCES**  
MALE AND FEMALE CAR DRIVERS: DIFFERENCES  
OBSERVED IN ACCIDENTS  
HS-022 674
- DIRECT**  
ARAMIDS AND POLYIMIDES DIRECT-FORM INTO  
HIGH-PERFORMANCE PLASTICS  
HS-022 652
- DIRECTIVE**  
AIR BRAKING SYSTEMS FOR COMMERCIAL VEHICLES  
IN COMPLIANCE WITH THE EEC-DIRECTIVE  
71/320 BRAKING  
HS-022 602
- DISC**  
DISC BRAKE SQUEAL  
HS-022 584
- DISC BRAKES FOR COMMERCIAL VEHICLES  
HS-022 600
- PARAMETERS FOR THE USE OF DISC BRAKES  
INCORPORATING AUTOMATICALLY ADJUSTED  
HAND-BRAKE MECHANISMS  
HS-022 620
- DISPLAYS**  
PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION  
OF WORD MESSAGE AND OPERATION  
HS-022 630
- DISTANCES**  
RECOGNITION DISTANCES OF VEHICLE REAR  
MARKINGS AT NIGHT  
HS-022 689
- DISTRIBUTIONS**  
EVALUATION OF THE BRAKING PERFORMANCE OF  
PASSENGER CARS WITH FIXED AND WITH  
'KINKED' BRAKE-FORCE DISTRIBUTIONS  
HS-022 577
- DISTRIBUTOR**  
NEW IGNITION SYSTEM ELIMINATES DISTRIBUTOR  
HS-022 657
- DISTRICT**  
A METHOD FOR ESTIMATING PEDESTRIAN  
VOLUME IN A CENTRAL BUSINESS DISTRICT  
HS-022 631
- DIVISION**  
BRAKING OF ROAD VEHICLES. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL

CAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

COMPILATION OF REPORTS GENERATED BY THE TIRE SYSTEMS DIVISION, SAFETY RESEARCH LABORATORY, 1967 THRU JANUARY 1978. PRELIMINARY REPORT

HS-803 312

## DOWNTOWN

BICYCLE TRANSPORTATION FOR DOWNTOWN WORK TRIPS: A CASE STUDY IN DAVIS, CALIFORNIA

HS-022 633

## DRINKING

FEASIBILITY OF DETERMINING BLOOD ALCOHOL CONCENTRATIONS IN SOCIAL DRINKING SETTINGS

HS-022 649

## DRIVE

EFFICIENT VEHICLE PACKAGING WITH FRONT-WHEEL DRIVE

HS-022 604

## DRIVER

A REANALYSIS OF CALIFORNIA DRIVER VISION DATA: GENERAL FINDINGS

HS-022 675

AN INTERVIEW SURVEY OF MOTORWAY DRIVER INFORMATION REQUIREMENTS AND SIGNAL UNDERSTANDING

HS-022 673

MEASURING THE OUTCOMES OF DRIVER TRAINING: UNIVERSITY OF SOUTHERN CALIFORNIA DRIVER PERFORMANCE TEST

HS-022 639

PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY

HS-022 626

THE DEVELOPMENT OF RUMBLE AREAS AS A DRIVER ALERTING DEVICE

HS-022 686

## DRIVERS

'AWARE,' AN IN-VEHICLE VISUAL COMMUNICATION SYSTEM FOR DRIVERS

HS-022 685

BEHAVIOUR OF DRIVERS ON YELLOW BAR PATTERNS - EXPERIMENT ON ALTON BY-PASS, HAMPSHIRE

HS-022 679

IMPLICATIONS OF SOME CHARACTERISTICS OF DRIVERS FOR BRAKE SYSTEM PERFORMANCE

HS-022 586

MALE AND FEMALE CAR DRIVERS: DIFFERENCES OBSERVED IN ACCIDENTS

HS-022 674

THE COVERT RESPONSES OF DRIVERS TO TWO ROAD BASED ALERTING DEVICES

HS-022 680

## DRIVING

A CONTENT ANALYSIS OF FIVE BOOKS ON DRIVING

HS-022 688

AN EXPERIMENTAL STUDY OF THE DEFENSIVE DRIVING COURSE

HS-022 638

HIGH DRIVING [DRUNK DRIVING]

HS-022 549

## DRUM

A THEORY OF DRUM BRAKE SQUEAL

HS-022 585

## DRUNK

HIGH DRIVING [DRUNK DRIVING]

HS-022 549

## DUAL

TESTS CONFIRM FORMABILITY OF DUAL-PHASE, HIGH-STRENGTH STEEL SHEET

HS-022 653

## DUMMY

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OCTOBER TO 31 OCTOBER 1977

HS-803 313

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 9, 1 NOVEMBER TO 30 NOVEMBER 1977

HS-803 318

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 10, 1 DECEMBER TO 31 DECEMBER 1977

HS-803 319

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978

HS-803 320

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978

HS-803 321

## DURABILITY

THE ADHESIVE TESTING OF HIGH STRENGTH LAMINATES FOR STRUCTURAL DURABILITY

HS-022 678

## DUTY

TOXIC GASES IN HEAVY DUTY DIESEL TRUCK CABS. FINAL REPORT

HS-022 696

## DYNAMIC

DYNAMIC CORNERING PROPERTIES OF TIRES

HS-022 607

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS TECHNIQUES

HS-022 621

August 31, 1978

PLASTIC DEFORMATIONS AND ENERGY CONSUMPTION AT DYNAMIC (IMPACT) LOADS

HS-022 543

THE EFFECT OF HYDROPLANING ON THE DYNAMIC CHARACTERISTICS OF CAR, TRUCK AND BUS TIRES

HS-022 608

## DYNAMICS

THE DYNAMICS OF WHEEL BRAKING

HS-022 572

THE INFLUENCE OF WHEEL SLIP CONTROL DYNAMICS ON VEHICLE STABILITY DURING BRAKING AND STEERING

HS-022 573

## DYNAMOMETER

RECENT PROGRESS IN BRAKING TESTS BY USE OF A CAR DYNAMOMETER

HS-022 583

THE USE OF THE MOBILE TIRE TRACTION DYNAMOMETER IN RESEARCH

HS-022 609

## ECONOMIC

DESIGN INNOVATIONS FACILITATING ECONOMIC PRODUCTION OF GIANT MOULDINGS

HS-022 552

ECONOMIC COMPARISON OF FUTURE AUTOMOTIVE POWER SYSTEMS

HS-022 518

## ECONOMY

AERODYNAMIC IMPROVEMENTS--A GREAT POTENTIAL FOR BETTER FUEL ECONOMY

HS-022 615

AN OVERALL DESIGN APPROACH TO IMPROVING PASSENGER CAR FUEL ECONOMY

HS-022 605

FUEL ECONOMY OF THE GASOLINE ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS

HS-022 661

HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY

HS-022 517

IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMOTIVE FUEL ECONOMY AND EMISSIONS

HS-022 515

MILEAGE MARATHONS [FUEL ECONOMY]

HS-022 672

MOTOR GASOLINE AND THE EFFECT OF COMPRESSION RATIO ON OCTANE REQUIREMENT AND FUEL ECONOMY

HS-022 663

PRINCIPLES GOVERNING FUEL ECONOMY IN A GASOLINE ENGINE

HS-022 662

THE EFFECT OF CRANKCASE LUBRICANTS ON FUEL ECONOMY

HS-022 670

THE EFFECT OF EMISSION CONTROLS ON FUEL ECONOMY

HS-022 668

THE EFFECT OF GASOLINE ADDITIVES ON FUEL ECONOMY

HS-022 665

THE EFFECT OF MIXTURE PREPARATION ON FUEL ECONOMY

HS-022 666

THE EFFECT OF THE PHYSICAL PROPERTIES OF GASOLINE ON FUEL ECONOMY

HS-022 664

THE EFFECT OF TRANSMISSION LUBRICANTS ON FUEL ECONOMY

HS-022 671

THE EFFECT OF VEHICLE MAINTENANCE ON FUEL ECONOMY

HS-022 667

THE MEASUREMENT OF FUEL ECONOMY

HS-022 669

## EEC

AIR BRAKING SYSTEMS FOR COMMERCIAL VEHICLES IN COMPLIANCE WITH THE EEC-DIRECTIVE 71/320 BRAKING

HS-022 602

## EFFECTIVE

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST OF ELECTRIC VEHICLES

HS-022 611

## EFFECTIVENESS

A COMPARISON OF ADVANCED BELT SYSTEMS REGARDING THEIR EFFECTIVENESS

HS-022 623

INTERIM ANALYSIS OF STR [SHORT TERM REHABILITATION] PERFORMANCE AND EFFECTIVENESS. TWELVE-MONTH ANALYSES

HS-803 285

OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES

HS-022 590

## EFFICIENT

EFFICIENT VEHICLE PACKAGING WITH FRONT-WHEEL DRIVE

HS-022 604

## ELDERLY

TRANSPORTATION FOR ELDERLY AND HANDICAPPED PERSONS

HS-022 554

## ELECTRIC

CALIFORNIANS LEAD THE WAY IN DEVELOPMENT OF ELECTRIC CARS

HS-022 699

ELECTRIC VEHICLE SYSTEMS FY 1978. ENVIRONMENTAL DEVELOPMENT PLAN

HS-022 645

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST OF ELECTRIC VEHICLES

HS-022 611

OVERVIEW OF ELECTRIC VEHICLES IN THE UNITED STATES

HS-022 522

TEST AND EVALUATION OF 23 ELECTRIC VEHICLES FOR STATE-OF-THE-ART ASSESSMENT

HS-022 619

## **ELECTRONIC**

TEMPERATURE SENSORS FOR ELECTRONIC ENGINE CONTROL SYSTEMS

HS-022 562

## **ELEMENT**

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS TECHNIQUES

HS-022 621

## **ELIMINATES**

NEW IGNITION SYSTEM ELIMINATES DISTRIBUTOR

HS-022 657

## **EMERGENCY**

A DESIGN AND EVALUATION STUDY OF HAND-HOLDS AND FOOTHOLDS FOR EMERGENCY WINDOWS OF CLASS III PUBLIC SERVICE VEHICLES [BUSES]

HS-022 529

## **EMISSION**

THE EFFECT OF EMISSION CONTROLS ON FUEL ECONOMY

HS-022 668

## **EMISSIONS**

HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY

HS-022 517

IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMOTIVE FUEL ECONOMY AND EMISSIONS

HS-022 515

PLANNING FOR THE AUTOMOBILE IN THE SCAG [SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS] REGION. AN EVALUATION OF ALTERNATIVES FOR REDUCING AUTOMOBILE EMISSIONS AND FUEL CONSUMPTION

HS-022 650

## **ENERGY**

DESIGN CONSIDERATIONS IN ENERGY ABSORPTION BY STRUCTURAL COLLAPSE

HS-022 624

ENERGY ABSORPTION BY THE PLASTIC DEFORMATION OF BODY STRUCTURAL MEMBERS

HS-022 622

ENERGY USE AND OTHER COMPARISONS BETWEEN DIESEL AND GASOLINE PICKUP TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977

HS-022 548

PLASTIC DEFORMATIONS AND ENERGY CONSUMPTION AT DYNAMIC (IMPACT) LOADS

HS-022 543

## **ENFORCEMENT**

A STUDY OF MALE MOTORISTS' ATTITUDES TO SPEED RESTRICTIONS AND THEIR ENFORCEMENT

HS-022 682

EVALUATION OF SCREENING BREATH TESTING IN TRAFFIC LAW ENFORCEMENT. FINAL REPORT

HS-803 274

## **ENGINE**

A WORLDWIDE OVERVIEW OF AUTOMOTIVE ENGINE CONTROL SENSOR TECHNOLOGY

HS-022 558

APPLICATION OF A CRANKSHAFT POSITION SENSOR TO CONTROL ENGINE TIMING

HS-022 564

APPLICATION OF AUTOMOTIVE SENSORS TO ENGINE CONTROL

HS-022 561

ENGINE DESIGN SERIES: FUEL SYSTEMS--DIESEL

HS-022 659

FEASIBILITY TEST ON COMPOUNDING THE INTERNAL COMBUSTION ENGINE FOR AUTOMOTIVE VEHICLES, TASK 2. FINAL REPORT

HS-022 646

FUEL ECONOMY OF THE GASOLINE ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS

HS-022 661

PRINCIPLES GOVERNING FUEL ECONOMY IN A GASOLINE ENGINE

HS-022 662

TEMPERATURE SENSORS FOR ELECTRONIC ENGINE CONTROL SYSTEMS

HS-022 562

## **ENGINEERING**

POWER TRAIN ENGINEERING FOR PUBLIC SERVICE VEHICLES [BUSES]

HS-022 545

## **ENGINEERS**

BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977

HS-022 527

## **ENGINES**

AN ASSESSMENT OF THE TECHNOLOGY OF RANKINE ENGINES FOR AUTOMOBILES

HS-022 647

WHAT'S NEW WITH COE'S [CABS-OVER-ENGINES]

HS-022 651

## **ENGLAND**

BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

August 31, 1978

THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977

HS-022 527

#### ENVIRONMENTAL

ELECTRIC VEHICLE SYSTEMS FY 1978. ENVIRONMENTAL DEVELOPMENT PLAN

HS-022 645

ENVIRONMENTAL REQUIREMENTS FOR PSV [PUBLIC SERVICE VEHICLE] OPERATION [BUSES]

HS-022 530

#### EQUIPMENT

ARE PEOPLE STILL GETTING BIGGER--WHO, WHERE, AND HOW MUCH? [DESIGN OF AUTOMOTIVE EQUIPMENT]

HS-022 616

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM

HS-022 701

NEW STANDARD BUS EQUIPMENT

HS-022 555

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT

HS-022 691

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE AND RELAY DEVICES AND TECHNIQUES. FINAL REPORT

HS-022 692

#### ESTIMATE

THE 1979 ESTIMATE OF THE COST OF COMPLETING THE INTERSTATE SYSTEM. INSTRUCTION MANUAL FOR PREPARATION AND SUBMISSION

HS-022 553

#### ETHIOPIA

THE EFFECT OF VEHICLE AND ROAD CHARACTERISTICS ON COMMERCIAL VEHICLE SPEEDS IN ETHIOPIA

HS-022 681

#### EUROPE

BRAKING REGULATIONS IN EUROPE

HS-022 596

LEGISLATIVE CONTROL OF ARTICULATED VEHICLE BRAKING [EUROPE]

HS-022 595

#### EVALUATE

USING COMPUTER SIMULATION TO EVALUATE AND IMPROVE VEHICLE HANDLING

HS-022 513

#### EVALUATION

A DESIGN AND EVALUATION STUDY OF HAND-HOLDS AND FOOTHOLDS FOR EMERGENCY WINDOWS OF CLASS III PUBLIC SERVICE VEHICLES [BUSES]

HS-022 529

EVALUATION OF MEETING BEAMS OF TWO- AND THREE-BEAM HEADLIGHTING SYSTEMS

HS-022 700

EVALUATION OF SCREENING BREATH TESTING IN TRAFFIC LAW ENFORCEMENT. FINAL REPORT

HS-803 274

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OCTOBER TO 31 OCTOBER 1977

HS-803 313

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 9, 1 NOVEMBER TO 30 NOVEMBER 1977

HS-803 318

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 10, 1 DECEMBER TO 31 DECEMBER 1977

HS-803 319

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978

HS-803 320

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978

HS-803 321

EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS

HS-022 577

PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION OF WORD MESSAGE AND OPERATION

HS-022 630

PLANNING FOR THE AUTOMOBILE IN THE SCAG [SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS] REGION. AN EVALUATION OF ALTERNATIVES FOR REDUCING AUTOMOBILE EMISSIONS AND FUEL CONSUMPTION

HS-022 650

TEST AND EVALUATION OF 23 ELECTRIC VEHICLES FOR STATE-OF-THE-ART ASSESSMENT

HS-022 619

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT

HS-022 625

#### EXECUTIVE

ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION--A FEASIBILITY STUDY. VOL. 1--EXECUTIVE SUMMARY

HS-022 643

- RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 1: EXECUTIVE SUMMARY. FINAL REPORT  
HS-803 249
- EXPERIMENT**  
BEHAVIOUR OF DRIVERS ON YELLOW BAR PATTERNS - EXPERIMENT ON ALTON BY-PASS, HAMPSHIRE  
HS-022 679
- EXPERIMENTAL**  
AN EXPERIMENTAL STUDY OF THE DEFENSIVE DRIVING COURSE  
HS-022 638
- FACILITATING**  
DESIGN INNOVATIONS FACILITATING ECONOMIC PRODUCTION OF GIANT MOULDINGS  
HS-022 552
- FACILITIES**  
PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY  
HS-022 626
- FEASIBILITY**  
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION--A FEASIBILITY STUDY. VOL. 1--EXECUTIVE SUMMARY  
HS-022 643  
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION --A FEASIBILITY STUDY. VOL. 2--TECHNICAL SECTION  
HS-022 644  
FEASIBILITY OF DETERMINING BLOOD ALCOHOL CONCENTRATIONS IN SOCIAL DRINKING SETTINGS  
HS-022 649  
FEASIBILITY TEST ON COMPOUNDING THE INTERNAL COMBUSTION ENGINE FOR AUTOMOTIVE VEHICLES, TASK 2. FINAL REPORT  
HS-022 646
- FEMALE**  
MALE AND FEMALE CAR DRIVERS: DIFFERENCES OBSERVED IN ACCIDENTS  
HS-022 674
- FIELD**  
VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT  
HS-022 625
- FINITE**  
DYNAMIC SIMULATION OF AN AUTOMOBILE BODY UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS TECHNIQUES  
HS-022 621
- FITTED**  
ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING  
HS-022 677
- FIXED**  
EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS  
HS-022 577
- FLEET**  
AUTOMOTIVE FLEET FUEL CONSUMPTION MODEL: FUEL. FOR. FINAL REPORT  
HS-803 223
- FLESH**  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OCTOBER TO 31 OCTOBER 1977  
HS-803 313  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 9, 1 NOVEMBER TO 30 NOVEMBER 1977  
HS-803 318  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 10, 1 DECEMBER TO 31 DECEMBER 1977  
HS-803 319  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978  
HS-803 320  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978  
HS-803 321
- FOAMING**  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OCTOBER TO 31 OCTOBER 1977  
HS-803 313  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 9, 1 NOVEMBER TO 30 NOVEMBER 1977  
HS-803 318  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 10, 1 DECEMBER TO 31 DECEMBER 1977  
HS-803 319  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978  
HS-803 320  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978  
HS-803 321



August 31, 1978

## FOOTHOLDS

A DESIGN AND EVALUATION STUDY OF HANDHOLDS AND FOOTHOLDS FOR EMERGENCY WINDOWS OF CLASS III PUBLIC SERVICE VEHICLES [BUSES]

HS-022 529

## FORCE

EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS

HS-022 577

## FORM

ARAMIDS AND POLYIMIDES DIRECT-FORM INTO HIGH-PERFORMANCE PLASTICS

HS-022 652

## FORMABILITY

TESTS CONFIRM FORMABILITY OF DUAL-PHASE, HIGH-STRENGTH STEEL SHEET

HS-022 653

## FORMING

A PRIMER ON FORMING ALUMINUM SHEET

HS-022 655

## FOUNDATION

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM

HS-022 701

## FREEDOM

THE 1980'S: CHALLENGES OF CHANGE CONFRONTING THE MOTOR VEHICLE AND FREEDOM OF MOBILITY

HS-022 547

## FREQUENCY

TARGET IDENTIFICATION CAPABILITY OF SWEEPED FREQUENCY AUTOMOBILE RADAR

HS-022 613

## FRICITION

WET FRICTION--TYRE [TIRE] AND ROAD [BRAKING]

HS-022 575

## FRONT

EFFICIENT VEHICLE PACKAGING WITH FRONT-WHEEL DRIVE

HS-022 604

## FRONTAL

PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS] OCCUPANTS IN FRONTAL IMPACTS

HS-022 546

## FUEL

A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR

HS-022 563

AERODYNAMIC IMPROVEMENTS--A GREAT POTENTIAL FOR BETTER FUEL ECONOMY

HS-022 615

AN OVERALL DESIGN APPROACH TO IMPROVING PASSENGER CAR FUEL ECONOMY

HS-022 605

AUTOMOTIVE FLEET FUEL CONSUMPTION MODEL: FUEL. FOR. FINAL REPORT

HS-803 223

ENGINE DESIGN SERIES: FUEL SYSTEMS--DIESEL

HS-022 659

FUEL ECONOMY OF THE GASOLINE ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS

HS-022 661

HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY

HS-022 517

IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMOTIVE FUEL ECONOMY AND EMISSIONS

HS-022 515

MILEAGE MARATHONS [FUEL ECONOMY]

HS-022 672

MOTOR GASOLINE AND THE EFFECT OF COMPRESSION RATIO ON OCTANE REQUIREMENT AND FUEL ECONOMY

HS-022 663

PLANNING FOR THE AUTOMOBILE IN THE SCAG [SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS] REGION. AN EVALUATION OF ALTERNATIVES FOR REDUCING AUTOMOBILE EMISSIONS AND FUEL CONSUMPTION

HS-022 650

PRINCIPLES GOVERNING FUEL ECONOMY IN A GASOLINE ENGINE

HS-022 662

THE EFFECT OF CRANKCASE LUBRICANTS ON FUEL ECONOMY

HS-022 670

THE EFFECT OF EMISSION CONTROLS ON FUEL ECONOMY

HS-022 668

THE EFFECT OF GASOLINE ADDITIVES ON FUEL ECONOMY

HS-022 665

THE EFFECT OF MIXTURE PREPARATION ON FUEL ECONOMY

HS-022 666

THE EFFECT OF THE PHYSICAL PROPERTIES OF GASOLINE ON FUEL ECONOMY

HS-022 664

THE EFFECT OF TRANSMISSION LUBRICANTS ON FUEL ECONOMY

HS-022 671

THE EFFECT OF VEHICLE MAINTENANCE ON FUEL ECONOMY

HS-022 667

THE MEASUREMENT OF FUEL ECONOMY

HS-022 669

## FUELS

ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION --A FEASIBILITY STUDY. VOL. 2--TECHNICAL SECTION

HS-022 644

ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION--A FEASIBILITY STUDY. VOL. 1--EXECUTIVE SUMMARY

HS-022 643

## **GASES**

TOXIC GASES IN HEAVY DUTY DIESEL TRUCK  
CABS. FINAL REPORT

HS-022 696

## **GASOLINE**

ENERGY USE AND OTHER COMPARISONS  
BETWEEN DIESEL AND GASOLINE PICKUP  
TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977

HS-022 548

FUEL ECONOMY OF THE GASOLINE ENGINE.  
FUEL, LUBRICANT AND OTHER EFFECTS

HS-022 661

MOTOR GASOLINE AND THE EFFECT OF COMPRES-  
SION RATIO ON OCTANE REQUIREMENT AND FUEL  
ECONOMY

HS-022 663

PRINCIPLES GOVERNING FUEL ECONOMY IN A  
GASOLINE ENGINE

HS-022 662

THE EFFECT OF GASOLINE ADDITIVES ON FUEL  
ECONOMY

HS-022 665

THE EFFECT OF THE PHYSICAL PROPERTIES OF  
GASOLINE ON FUEL ECONOMY

HS-022 664

## **GENERATED**

COMPILATION OF REPORTS GENERATED BY THE  
TIRE SYSTEMS DIVISION, SAFETY RESEARCH  
LABORATORY, 1967 THRU JANUARY 1978. PRELIMI-  
NARY REPORT

HS-803 312

## **GIANT**

DESIGN INNOVATIONS FACILITATING ECONOMIC  
PRODUCTION OF GIANT MOULDINGS

HS-022 552

## **GOVERNING**

PRINCIPLES GOVERNING FUEL ECONOMY IN A  
GASOLINE ENGINE

HS-022 662

## **GOVERNMENT**

WORKSHOPS ON TRANSPORTATION-AIR QUALITY  
RESEARCH NEEDS FOR STATE, REGIONAL, AND  
LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

## **GOVERNMENTS**

PLANNING FOR THE AUTOMOBILE IN THE SCAG  
[SOUTHERN CALIFORNIA ASSOCIATION OF  
GOVERNMENTS] REGION. AN EVALUATION OF AL-  
TERNATIVES FOR REDUCING AUTOMOBILE EMIS-  
SIONS AND FUEL CONSUMPTION

HS-022 650

## **GRADE**

CRASH SAFETY FOR RAILROAD PASSENGERS,  
TRAIN CREWS AND GRADE CROSSING CRASH VIC-  
TIMS

HS-022 514

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 1; OVERVIEW, TECHNOLOGY

SURVEY AND RELAY ALTERNATIVES. FINAL RE-  
PORT

HS-022 691

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE  
AND RELAY DEVICES AND TECHNIQUES. FINAL  
REPORT

HS-022 692

## **GROSS**

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE  
WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST  
OF ELECTRIC VEHICLES

HS-022 611

## **GROW**

PASSIVE VEHICLE SAFETY AS CARS GROW  
SMALLER

HS-022 617

## **HAMPSHIRE**

BEHAVIOUR OF DRIVERS ON YELLOW BAR PAT-  
TERNS - EXPERIMENT ON ALTON BY-PASS,  
HAMPSHIRE

HS-022 679

## **HANDBRAKE**

PARAMETERS FOR THE USE OF DISC BRAKES IN-  
CORPORATING AUTOMATICALLY ADJUSTED HAND-  
BRAKE MECHANISMS

HS-022 620

## **HANDHOLDS**

A DESIGN AND EVALUATION STUDY OF HAND-  
HOLDS AND FOOTHOLDS FOR EMERGENCY WIN-  
DOWS OF CLASS III PUBLIC SERVICE VEHICLES  
[BUSES]

HS-022 529

## **HANDICAPPED**

TRANSPORTATION FOR ELDERLY AND HAN-  
DICAPPED PERSONS

HS-022 554

## **HANDLING**

A DATA RECORDING SYSTEM OF THE PATH OF A  
TEST VEHICLE BY LASER BEAM AND SOME APPLI-  
CATIONS TO STEERING HANDLING TEST

HS-022 520

USING COMPUTER SIMULATION TO EVALUATE  
AND IMPROVE VEHICLE HANDLING

HS-022 513

## **HEADLIGHTING**

EVALUATION OF MEETING BEAMS OF TWO- AND  
THREE-BEAM HEADLIGHTING SYSTEMS

HS-022 700

THE RELATIVE MERITS OF DIFFERENT LOW BEAM  
HEADLIGHTING SYSTEMS - A REVIEW OF THE  
LITERATURE. FINAL REPORT

HS-022 704

## **HEATING**

HEATING AND VENTILATING [OF BUSES] IN U.K.  
[UNITED KINGDOM]

HS-022 532

August 31, 1978

## HEAVY

TOXIC GASES IN HEAVY DUTY DIESEL TRUCK  
CABS. FINAL REPORT

HS-022 696

## HELMET

ANALYSIS OF THE MANDATORY MOTORCYCLE  
HELMET ISSUE

HS-022 694

## HELMETS

SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT  
STUDY AMONGST CHILDREN

HS-022 684

## HIGH

ARAMIDS AND POLYIMIDES DIRECT-FORM INTO  
HIGH-PERFORMANCE PLASTICS

HS-022 652

HIGH DRIVING [DRUNK DRIVING]

HS-022 549

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR  
BIOSCIENCES RESEARCH: FINAL TECHNICAL  
LETTER REPORT ON NSF [NATIONAL SCIENCE  
FOUNDATION] PROGRAM

HS-022 701

TESTS CONFIRM FORMABILITY OF DUAL-PHASE,  
HIGH-STRENGTH STEEL SHEET

HS-022 653

THE ADHESIVE TESTING OF HIGH STRENGTH  
LAMINATES FOR STRUCTURAL DURABILITY

HS-022 678

## HIGHWAY

HIGHWAY ADVISORY RADIO IN CONSTRUCTION  
AREAS. FINAL REPORT

HS-022 697

NATIONAL HIGHWAY SAFETY ADVISORY COMMIT-  
TEE ON ALCOHOL SAFETY ADJUDICATION. FINAL  
REPORT

HS-802 510

## HUMAN

CYBERMAN--A HUMAN FACTORS DESIGN TOOL

HS-022 618

RELIABILITY, MAINTAINABILITY, SAFETY AND  
HUMAN FACTOR (RMSH) CONSIDERATIONS IN THE  
AUTOMOTIVE INDUSTRY

HS-022 519

## HUNGARY

BUS RESEARCH AND DEVELOPMENT AT AUTOKUT  
RESEARCH INSTITUTE, HUNGARY

HS-022 540

## HYDRAULIC

HYDRAULIC SUSPENSIONS WITH PARTICULAR  
REFERENCE TO PUBLIC SERVICE VEHICLES  
[BUSES]

HS-022 534

## HYDROPLANING

THE EFFECT OF HYDROPLANING ON THE DYNAM-  
IC CHARACTERISTICS OF CAR, TRUCK AND BUS  
TIRES

HS-022 608

## IDENTIFICATION

TARGET IDENTIFICATION CAPABILITY OF SWEEP  
FREQUENCY AUTOMOBILE RADAR

HS-022 613

## IGNITION

NEW IGNITION SYSTEM ELIMINATES DISTRIBUTOR

HS-022 657

## IMPACT

EVALUATING THE IMPACT OF WEATHER ON BICY-  
CLE USE

HS-022 635

IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMO-  
TIVE FUEL ECONOMY AND EMISSIONS

HS-022 515

PLASTIC DEFORMATIONS AND ENERGY CONSUMP-  
TION AT DYNAMIC (IMPACT) LOADS

HS-022 543

## IMPACTS

PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS]  
OCCUPANTS IN FRONTAL IMPACTS

HS-022 546

## IMPLICATIONS

IMPLICATIONS OF SOME CHARACTERISTICS OF  
DRIVERS FOR BRAKE SYSTEM PERFORMANCE

HS-022 586

## IMPROVE

USING COMPUTER SIMULATION TO EVALUATE  
AND IMPROVE VEHICLE HANDLING

HS-022 513

## IMPROVEMENTS

AERODYNAMIC IMPROVEMENTS--A GREAT POTEN-  
TIAL FOR BETTER FUEL ECONOMY

HS-022 615

## IMPROVING

AN OVERALL DESIGN APPROACH TO IMPROVING  
PASSENGER CAR FUEL ECONOMY

HS-022 605

## INCORPORATING

PARAMETERS FOR THE USE OF DISC BRAKES IN-  
CORPORATING AUTOMATICALLY ADJUSTED HAND-  
BRAKE MECHANISMS

HS-022 620

## INCREASED

AIR BRAKING SYSTEMS WITH INCREASED PRES-  
SURE

HS-022 598

## INDUSTRY

RELIABILITY, MAINTAINABILITY, SAFETY AND  
HUMAN FACTOR (RMSH) CONSIDERATIONS IN THE  
AUTOMOTIVE INDUSTRY

HS-022 519

REPAIR INDUSTRY RESPONSE TO DIAGNOSTIC IN-  
SPECTION PROJECTS

HS-022 516

## INFORMATION

AN INTERVIEW SURVEY OF MOTORWAY DRIVER  
INFORMATION REQUIREMENTS AND SIGNAL UN-  
DERSTANDING

HS-022 673

**INJURY**

DEATH AND INJURY ROAD ACCIDENTS IN  
NORTHERN IRELAND 1976

HS-022 693

NECK INJURY ASSESSMENT PROTOCOL. FINAL RE-  
PORT

HS-803 287

**INNOVATIONS**

DESIGN INNOVATIONS FACILITATING ECONOMIC  
PRODUCTION OF GIANT MOULDINGS

HS-022 552

**INSPECTION**

IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMO-  
TIVE FUEL ECONOMY AND EMISSIONS

HS-022 515

REPAIR INDUSTRY RESPONSE TO DIAGNOSTIC IN-  
SPECTION PROJECTS

HS-022 516

**INSPECTIONS**

DEFECTS IN ROAD VEHICLE BRAKING SYSTEMS--  
EXPERIENCE FROM STATUTORY INSPECTIONS

HS-022 592

**INSTITUTE**

BRAKING OF ROAD VEHICLES. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIVISION, IN AS-  
SOCIATION WITH THE INSTITUTE OF ROAD TRANS-  
PORT ENGINEERS, LOUGHBOROUGH UNIVERSITY  
OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

BUS RESEARCH AND DEVELOPMENT AT AUTOKUT  
RESEARCH INSTITUTE, HUNGARY

HS-022 540

**INSTITUTION**

BRAKING OF ROAD VEHICLES. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIVISION, IN AS-  
SOCIATION WITH THE INSTITUTE OF ROAD TRANS-  
PORT ENGINEERS, LOUGHBOROUGH UNIVERSITY  
OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

THE DESIGN, CONSTRUCTION AND OPERATION OF  
PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIV., AND SCHOOL  
OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977

HS-022 527

**INSTRUCTION**

THE 1979 ESTIMATE OF THE COST OF COMPLETING  
THE INTERSTATE SYSTEM. INSTRUCTION MANUAL  
FOR PREPARATION AND SUBMISSION

HS-022 553

**INTEGRAL**

ANALYTICAL COMPARISON OF INTEGRAL AND  
CHASSIS DESIGN ON BUSES

HS-022 539

**INTERFACE**

THE TYRE/ROAD [TIRE/ROAD] INTERFACE--ITS EF-  
FECT ON BRAKING

HS-022 574

**INTERIM**

ENERGY USE AND OTHER COMPARISONS  
BETWEEN DIESEL AND GASOLINE PICKUP  
TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977

HS-022 548

INTERIM ANALYSIS OF STR [SHORT TERM REHA-  
BILITATION] PERFORMANCE AND EFFECTIVENESS.  
TWELVE-MONTH ANALYSES

HS-803 285

**INTERNAL**

FEASIBILITY TEST ON COMPOUNDING THE INTER-  
NAL COMBUSTION ENGINE FOR AUTOMOTIVE  
VEHICLES, TASK 2. FINAL REPORT

HS-022 646

**INTERSTATE**

THE 1979 ESTIMATE OF THE COST OF COMPLETING  
THE INTERSTATE SYSTEM. INSTRUCTION MANUAL  
FOR PREPARATION AND SUBMISSION

HS-022 553

**INTERVIEW**

AN INTERVIEW SURVEY OF MOTORWAY DRIVER  
INFORMATION REQUIREMENTS AND SIGNAL UN-  
DERSTANDING

HS-022 673

**INVESTIGATION**

INVESTIGATION OF PSV [PUBLIC SERVICE VEHI-  
CLE] ROLL OVER SAFETY [BUSES]

HS-022 535

**IRELAND**

DEATH AND INJURY ROAD ACCIDENTS IN  
NORTHERN IRELAND 1976

HS-022 693

**IRON**

CAST IRON BRAKE ROTOR METALLURGY

HS-022 581

**ISSUE**

ANALYSIS OF THE MANDATORY MOTORCYCLE  
HELMET ISSUE

HS-022 694

**ISSUES**

EVALUATING OPTIONS IN STATEWIDE TRANSPOR-  
TATION PLANNING/PROGRAMMING ISSUES,  
TECHNIQUES, AND THEIR RELATIONSHIPS

HS-022 550

**JACK**

ACCIDENTS TO ARTICULATED VEHICLES FITTED  
WITH LOAD SENSING OR ANTI-LOCKING BRAKES  
TO COUNTERACT JACK-KNIFING

HS-022 677

**JUL**

THE DESIGN, CONSTRUCTION AND OPERATION OF  
PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIV., AND SCHOOL  
OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977

HS-022 527

August 31, 1978

## **JUN**

ENERGY USE AND OTHER COMPARISONS BETWEEN DIESEL AND GASOLINE PICKUP TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977

HS-022 548

## **KINGDOM**

HEATING AND VENTILATING [OF BUSES] IN U.K. [UNITED KINGDOM]

HS-022 532

PROSPECTS FOR BUS AND COACH TRANSPORT [UNITED KINGDOM]

HS-022 528

STATUTORY TECHNICAL CONTROL OF PUBLIC SERVICE VEHICLES [BUSES] [UNITED KINGDOM]

HS-022 531

VEHICLE TYPES IN RELATION TO SPECIFIC OPERATING CONDITIONS [UNITED KINGDOM] [BUSES]

HS-022 536

## **KINKED**

EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS

HS-022 577

## **KNEE**

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT

HS-022 625

## **KNIFING**

ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING

HS-022 677

## **KNOWLEDGE**

KNOWLEDGE AND PERCEPTIONS OF YOUNG PEDESTRIANS

HS-022 629

## **LABORATORY**

COMPILATION OF REPORTS GENERATED BY THE TIRE SYSTEMS DIVISION, SAFETY RESEARCH LABORATORY, 1967 THRU JANUARY 1978. PRELIMINARY REPORT

HS-803 312

## **LAMINATES**

THE ADHESIVE TESTING OF HIGH STRENGTH LAMINATES FOR STRUCTURAL DURABILITY

HS-022 678

## **LANE**

EFFECT OF BICYCLE LANE USAGE ON VEHICLES IN THE ADJACENT LANE

HS-022 637

## **LASER**

A DATA RECORDING SYSTEM OF THE PATH OF A TEST VEHICLE BY LASER BEAM AND SOME APPLICATIONS TO STEERING HANDLING TEST

HS-022 520

## **LATERAL**

LATERAL STABILITY OF COMMERCIAL ROAD VEHICLE TRAINS UNDER BRAKING CONDITIONS

HS-022 570

MEASUREMENTS OF THE LONGITUDINAL AND LATERAL TRACTION PROPERTIES OF TRUCK TIRES

HS-022 576

## **LAW**

EVALUATION OF SCREENING BREATH TESTING IN TRAFFIC LAW ENFORCEMENT. FINAL REPORT

HS-803 274

## **LEAD**

CALIFORNIANS LEAD THE WAY IN DEVELOPMENT OF ELECTRIC CARS

HS-022 699

## **LEAN**

A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR

HS-022 563

## **LEGISLATION**

REVIEW OF BRAKING LEGISLATION IN BRITAIN DURING THE PAST DECADE

HS-022 597

## **LEGISLATIVE**

LEGISLATIVE CONTROL OF ARTICULATED VEHICLE BRAKING [EUROPE]

HS-022 595

## **LITERATURE**

THE RELATIVE MERITS OF DIFFERENT LOW BEAM HEADLIGHTING SYSTEMS - A REVIEW OF THE LITERATURE. FINAL REPORT

HS-022 704

## **LOAD**

ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING

HS-022 677

## **LOADS**

PLASTIC DEFORMATIONS AND ENERGY CONSUMPTION AT DYNAMIC (IMPACT) LOADS

HS-022 543

## **LOCAL**

WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS FOR STATE, REGIONAL, AND LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

## **LOCK**

PRACTICAL ASPECTS OF TESTING ANTI-LOCK SYSTEMS ON COMMERCIAL VEHICLES

HS-022 579

## **LOCKING**

ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING

HS-022 677

## **LONGITUDINAL**

MEASUREMENTS OF THE LONGITUDINAL AND LATERAL TRACTION PROPERTIES OF TRUCK TIRES

HS-022 576

- LOSS**  
ACCIDENTS INVOLVING LOSS OF CONTROL WHEN BRAKING - A STUDY OF THE ON-THE-SPOT SURVEY DATA  
HS-022 588
- LOUGHBOROUGH**  
BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976  
HS-022 566
- LOW**  
THE RELATIVE MERITS OF DIFFERENT LOW BEAM HEADLIGHTING SYSTEMS - A REVIEW OF THE LITERATURE. FINAL REPORT  
HS-022 704
- LUBRICANT**  
FUEL ECONOMY OF THE GASOLINE ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS  
HS-022 661
- LUBRICANTS**  
THE EFFECT OF CRANKCASE LUBRICANTS ON FUEL ECONOMY  
HS-022 670  
THE EFFECT OF TRANSMISSION LUBRICANTS ON FUEL ECONOMY  
HS-022 671
- MAINTAINABILITY**  
RELIABILITY AND MAINTAINABILITY OF BRAKING SYSTEMS--MILITARY APPLICATIONS  
HS-022 594  
RELIABILITY, MAINTAINABILITY, SAFETY AND HUMAN FACTOR (RMSH) CONSIDERATIONS IN THE AUTOMOTIVE INDUSTRY  
HS-022 519
- MAINTENANCE**  
HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY  
HS-022 517  
OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES  
HS-022 590  
THE EFFECT OF VEHICLE MAINTENANCE ON FUEL ECONOMY  
HS-022 667
- MALE**  
A STUDY OF MALE MOTORISTS' ATTITUDES TO SPEED RESTRICTIONS AND THEIR ENFORCEMENT  
HS-022 682  
MALE AND FEMALE CAR DRIVERS: DIFFERENCES OBSERVED IN ACCIDENTS  
HS-022 674
- MANDATORY**  
ANALYSIS OF THE MANDATORY MOTORCYCLE HELMET ISSUE  
HS-022 694
- MANUAL**  
THE 1979 ESTIMATE OF THE COST OF COMPLETING THE INTERSTATE SYSTEM. INSTRUCTION MANUAL FOR PREPARATION AND SUBMISSION  
HS-022 553
- MARATHONS**  
MILEAGE MARATHONS [FUEL ECONOMY]  
HS-022 672
- MARKINGS**  
RECOGNITION DISTANCES OF VEHICLE REAR MARKINGS AT NIGHT  
HS-022 689
- MATERIALS**  
THE CHOICE OF MATERIALS IN THE DESIGN AND CONSTRUCTION OF PUBLIC SERVICE VEHICLES [BUSES]  
HS-022 541
- MEANS**  
POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT  
HS-022 691  
POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE AND RELAY DEVICES AND TECHNIQUES. FINAL REPORT  
HS-022 692
- MEASUREMENT**  
THE MEASUREMENT OF FUEL ECONOMY  
HS-022 669
- MEASUREMENTS**  
MEASUREMENTS OF THE LONGITUDINAL AND LATERAL TRACTION PROPERTIES OF TRUCK TIRES  
HS-022 576
- MEASURING**  
MEASURING THE OUTCOMES OF DRIVER TRAINING: UNIVERSITY OF SOUTHERN CALIFORNIA DRIVER PERFORMANCE TEST  
HS-022 639
- MECHANICAL**  
BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976  
HS-022 566  
THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977  
HS-022 527

August 31, 1978

## **MECHANISMS**

PARAMETERS FOR THE USE OF DISC BRAKES INCORPORATING AUTOMATICALLY ADJUSTED HANDBRAKE MECHANISMS

HS-022 620

## **MEMBERS**

ENERGY ABSORPTION BY THE PLASTIC DEFORMATION OF BODY STRUCTURAL MEMBERS

HS-022 622

## **MERITS**

THE RELATIVE MERITS OF DIFFERENT LOW BEAM HEADLIGHTING SYSTEMS - A REVIEW OF THE LITERATURE. FINAL REPORT

HS-022 704

## **MESSAGE**

PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION OF WORD MESSAGE AND OPERATION

HS-022 630

## **METALLURGY**

CAST IRON BRAKE ROTOR METALLURGY

HS-022 581

## **METHOD**

A METHOD FOR ESTIMATING PEDESTRIAN VOLUME IN A CENTRAL BUSINESS DISTRICT

HS-022 631

## **MICHIGAN**

FACTOR STRUCTURE OF THE MICHIGAN ALCOHOLISM SCREENING TEST

HS-022 648

## **MILEAGE**

MILEAGE MARATHONS [FUEL ECONOMY]

HS-022 672

## **MILITARY**

RELIABILITY AND MAINTAINABILITY OF BRAKING SYSTEMS--MILITARY APPLICATIONS

HS-022 594

## **MIXTURE**

THE EFFECT OF MIXTURE PREPARATION ON FUEL ECONOMY

HS-022 666

## **MOBILE**

THE USE OF THE MOBILE TIRE TRACTION DYNAMOMETER IN RESEARCH

HS-022 609

## **MOBILITY**

THE 1980'S: CHALLENGES OF CHANGE CONFRONTING THE MOTOR VEHICLE AND FREEDOM OF MOBILITY

HS-022 547

## **MODAL**

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS TECHNIQUES

HS-022 621

## **MODEL**

A SCALE MODEL SIMULATION OF VEHICLE MOTIONS

HS-022 606

AUTOMOTIVE FLEET FUEL CONSUMPTION MODEL: FUEL. FOR. FINAL REPORT

HS-803 223

## **MONTH**

INTERIM ANALYSIS OF STR [SHORT TERM REHABILITATION] PERFORMANCE AND EFFECTIVENESS. TWELVE-MONTH ANALYSES

HS-803 285

## **MOTIONS**

A SCALE MODEL SIMULATION OF VEHICLE MOTIONS

HS-022 606

## **MOTOR**

MOTOR GASOLINE AND THE EFFECT OF COMPRESSION RATIO ON OCTANE REQUIREMENT AND FUEL ECONOMY

HS-022 663

MOTOR VEHICLE TRAFFIC ACCIDENTS 1976

HS-022 524

STUDY OF MOTOR VEHICLE SIGNAL SYSTEMS. FINAL REPORT

HS-022 690

THE 1980'S: CHALLENGES OF CHANGE CONFRONTING THE MOTOR VEHICLE AND FREEDOM OF MOBILITY

HS-022 547

## **MOTORCYCLE**

ANALYSIS OF THE MANDATORY MOTORCYCLE HELMET ISSUE

HS-022 694

MOTORCYCLE FACTS, NOVEMBER, 1977

HS-022 656

## **MOTORCYCLES**

THE STABILITY OF MOTORCYCLES IN ACCELERATION AND DECELERATION

HS-022 571

## **MOTORIST**

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT

HS-022 691

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE AND RELAY DEVICES AND TECHNIQUES. FINAL REPORT

HS-022 692

## **MOTORISTS**

A STUDY OF MALE MOTORISTS' ATTITUDES TO SPEED RESTRICTIONS AND THEIR ENFORCEMENT

HS-022 682

## **MOTORWAY**

AN INTERVIEW SURVEY OF MOTORWAY DRIVER INFORMATION REQUIREMENTS AND SIGNAL UNDERSTANDING

HS-022 673



**MOULDINGS**

DESIGN INNOVATIONS FACILITATING ECONOMIC PRODUCTION OF GIANT MOULDINGS

HS-022 552

**NASA**

THE NASA [NATIONAL AERONAUTICS AND SPACE ADMINISTRATION] NASTRAN STRUCTURAL ANALYSIS COMPUTER PROGRAM--NEW CONTENT

HS-022 521

**NASTRAN**

THE NASA [NATIONAL AERONAUTICS AND SPACE ADMINISTRATION] NASTRAN STRUCTURAL ANALYSIS COMPUTER PROGRAM--NEW CONTENT

HS-022 521

**NATIONAL**

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM

HS-022 701

NATIONAL HIGHWAY SAFETY ADVISORY COMMITTEE ON ALCOHOL SAFETY ADJUDICATION. FINAL REPORT

HS-802 510

STATEMENT AT THE NATIONAL PRESS CLUB, WASHINGTON, D.C., THURSDAY, SEPT. 1, 1977

HS-810 314

THE NASA [NATIONAL AERONAUTICS AND SPACE ADMINISTRATION] NASTRAN STRUCTURAL ANALYSIS COMPUTER PROGRAM--NEW CONTENT

HS-022 521

THE NATIONAL PSV [PUBLIC SERVICE VEHICLE] ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED STUDY [BUSES]

HS-022 544

**NATIONWIDE**

HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY

HS-022 517

**NECK**

NECK INJURY ASSESSMENT PROTOCOL. FINAL REPORT

HS-803 287

**NEEDS**

WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS FOR STATE, REGIONAL, AND LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

**NIGHT**

RECOGNITION DISTANCES OF VEHICLE REAR MARKINGS AT NIGHT

HS-022 689

**NORTHERN**

DEATH AND INJURY ROAD ACCIDENTS IN NORTHERN IRELAND 1976

HS-022 693

**NSF**

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM

HS-022 701

**OBSERVED**

MALE AND FEMALE CAR DRIVERS: DIFFERENCES OBSERVED IN ACCIDENTS

HS-022 674

**OCCUPANTS**

PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS] OCCUPANTS IN FRONTAL IMPACTS

HS-022 546

**OCTANE**

MOTOR GASOLINE AND THE EFFECT OF COMPRESSION RATIO ON OCTANE REQUIREMENT AND FUEL ECONOMY

HS-022 663

**OFFICIALS**

WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS FOR STATE, REGIONAL, AND LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

**OPERATING**

VEHICLE TYPES IN RELATION TO SPECIFIC OPERATING CONDITIONS [UNITED KINGDOM] [BUSES]

HS-022 536

**OPERATION**

ENVIRONMENTAL REQUIREMENTS FOR PSV [PUBLIC SERVICE VEHICLE] OPERATION [BUSES]

HS-022 530

PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION OF WORD MESSAGE AND OPERATION

HS-022 630

THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977

HS-022 527

THE EFFECT OF SURGICAL OPERATION ON THE 'BRAKE-CLUTCH SIMULATOR'

HS-022 589

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION

HS-022 542

**OPERATIONAL**

OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES

HS-022 590

**OPERATORS**

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS

August 31, 1978

FOR PUBLIC SERVICE VEHICLES [BUSES] IN  
URBAN OPERATION

HS-022 542

## OPTIONS

EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING ISSUES, TECHNIQUES, AND THEIR RELATIONSHIPS

HS-022 550

## ORIENTED

THE NATIONAL PSV [PUBLIC SERVICE VEHICLE] ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED STUDY [BUSES]

HS-022 544

## OUTCOMES

MEASURING THE OUTCOMES OF DRIVER TRAINING: UNIVERSITY OF SOUTHERN CALIFORNIA DRIVER PERFORMANCE TEST

HS-022 639

## OVERALL

AN OVERALL DESIGN APPROACH TO IMPROVING PASSENGER CAR FUEL ECONOMY

HS-022 605

## OVERVIEW

A WORLDWIDE OVERVIEW OF AUTOMOTIVE ENGINE CONTROL SENSOR TECHNOLOGY

HS-022 558

OVERVIEW OF ELECTRIC VEHICLES IN THE UNITED STATES

HS-022 522

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT

HS-022 691

## PACKAGING

EFFICIENT VEHICLE PACKAGING WITH FRONT-WHEEL DRIVE

HS-022 604

## PARTICIPATION

CITIZEN PARTICIPATION IN PLANNING AND DESIGNING BIKEWAYS

HS-022 634

## PARTICULAR

HYDRAULIC SUSPENSIONS WITH PARTICULAR REFERENCE TO PUBLIC SERVICE VEHICLES [BUSES]

HS-022 534

## PARTS

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OCTOBER TO 31 OCTOBER 1977

HS-803 313

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 9, 1 NOVEMBER TO 30 NOVEMBER 1977

HS-803 318

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 10, 1 DECEMBER TO 31 DECEMBER 1977

HS-803 319

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978

HS-803 320

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978

HS-803 321

## PASS

BEHAVIOUR OF DRIVERS ON YELLOW BAR PATTERNS - EXPERIMENT ON ALTON BY-PASS, HAMPSHIRE

HS-022 679

## PASSENGER

AN OVERALL DESIGN APPROACH TO IMPROVING PASSENGER CAR FUEL ECONOMY

HS-022 605

EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS

HS-022 577

HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY

HS-022 517

## PASSENGERS

CRASH SAFETY FOR RAILROAD PASSENGERS, TRAIN CREWS AND GRADE CROSSING CRASH VICTIMS

HS-022 514

## PASSIVE

PASSIVE VEHICLE SAFETY AS CARS GROW SMALLER

HS-022 617

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION-PROGRESS REPORT

HS-022 625

## PATH

A DATA RECORDING SYSTEM OF THE PATH OF A TEST VEHICLE BY LASER BEAM AND SOME APPLICATIONS TO STEERING HANDLING TEST

HS-022 520

## PATTERNS

BEHAVIOUR OF DRIVERS ON YELLOW BAR PATTERNS - EXPERIMENT ON ALTON BY-PASS, HAMPSHIRE

HS-022 679

## PAYLOAD

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST OF ELECTRIC VEHICLES

HS-022 611

**PEDAL**

SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT STUDY AMONGST CHILDREN

HS-022 684

**PEDESTRIAN**

A METHOD FOR ESTIMATING PEDESTRIAN VOLUME IN A CENTRAL BUSINESS DISTRICT

HS-022 631

PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY

HS-022 626

PEDESTRIAN DELAY AND PEDESTRIAN SIGNAL WARRANTS

HS-022 628

PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION OF WORD MESSAGE AND OPERATION

HS-022 630

SELECTION OF PEDESTRIAN SIGNAL PHASING

HS-022 627

**PEDESTRIANS**

ACCIDENT DATA BASE FOR URBAN PEDESTRIANS

HS-022 632

KNOWLEDGE AND PERCEPTIONS OF YOUNG PEDESTRIANS

HS-022 629

**PEOPLE**

ARE PEOPLE STILL GETTING BIGGER--WHO, WHERE, AND HOW MUCH? [DESIGN OF AUTOMOTIVE EQUIPMENT]

HS-022 616

**PERCEPTIONS**

KNOWLEDGE AND PERCEPTIONS OF YOUNG PEDESTRIANS

HS-022 629

**PERFORMANCE**

ARAMIDS AND POLYIMIDES DIRECT-FORM INTO HIGH-PERFORMANCE PLASTICS

HS-022 652

BRAKE PERFORMANCE AND COSTS--COMMERCIAL VEHICLES

HS-022 601

COMPUTER ANALYSIS OF ANTILOCK SYSTEM PERFORMANCE IN THE BRAKING OF COMMERCIAL VEHICLES

HS-022 578

EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS

HS-022 577

IMPLICATIONS OF SOME CHARACTERISTICS OF DRIVERS FOR BRAKE SYSTEM PERFORMANCE

HS-022 586

INTERIM ANALYSIS OF STR [SHORT TERM REHABILITATION] PERFORMANCE AND EFFECTIVENESS. TWELVE-MONTH ANALYSES

HS-803 285

MEASURING THE OUTCOMES OF DRIVER TRAINING: UNIVERSITY OF SOUTHERN CALIFORNIA DRIVER PERFORMANCE TEST

HS-022 639

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION

HS-022 542

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT

HS-022 625

**PERSONS**

TRANSPORTATION FOR ELDERLY AND HANDICAPPED PERSONS

HS-022 554

**PHASING**

SELECTION OF PEDESTRIAN SIGNAL PHASING

HS-022 627

**PHYSICAL**

THE EFFECT OF THE PHYSICAL PROPERTIES OF GASOLINE ON FUEL ECONOMY

HS-022 664

**PICKUP**

ENERGY USE AND OTHER COMPARISONS BETWEEN DIESEL AND GASOLINE PICKUP TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977

HS-022 548

**PILOT**

SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT STUDY AMONGST CHILDREN

HS-022 684

**PLAN**

ELECTRIC VEHICLE SYSTEMS FY 1978. ENVIRONMENTAL DEVELOPMENT PLAN

HS-022 645

**PLANNING**

CITIZEN PARTICIPATION IN PLANNING AND DESIGNING BIKEWAYS

HS-022 634

EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING ISSUES, TECHNIQUES, AND THEIR RELATIONSHIPS

HS-022 550

PLANNING FOR THE AUTOMOBILE IN THE SCAG [SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS] REGION. AN EVALUATION OF ALTERNATIVES FOR REDUCING AUTOMOBILE EMISSIONS AND FUEL CONSUMPTION

HS-022 650

**PLASTIC**

ENERGY ABSORPTION BY THE PLASTIC DEFORMATION OF BODY STRUCTURAL MEMBERS

HS-022 622

PLASTIC DEFORMATIONS AND ENERGY CONSUMPTION AT DYNAMIC (IMPACT) LOADS

HS-022 543

**PLASTICS**

ARAMIDS AND POLYIMIDES DIRECT-FORM INTO HIGH-PERFORMANCE PLASTICS

HS-022 652

August 31, 1978

## **PLY**

SOURCES OF ROLLING RESISTANCE IN RADIAL PLY TIRES

HS-022 612

## **POLYIMIDES**

ARAMIDS AND POLYIMIDES DIRECT-FORM INTO HIGH-PERFORMANCE PLASTICS

HS-022 652

## **POSITION**

APPLICATION OF A CRANKSHAFT POSITION SENSOR TO CONTROL ENGINE TIMING

HS-022 564

PRECISION POSITION-SENSORS IN AUTOMOTIVE APPLICATIONS

HS-022 560

## **POTENTIAL**

AERODYNAMIC IMPROVEMENTS--A GREAT POTENTIAL FOR BETTER FUEL ECONOMY

HS-022 615

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT

HS-022 691

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE AND RELAY DEVICES AND TECHNIQUES. FINAL REPORT

HS-022 692

## **POWER**

ECONOMIC COMPARISON OF FUTURE AUTOMOTIVE POWER SYSTEMS

HS-022 518

POWER TRAIN ENGINEERING FOR PUBLIC SERVICE VEHICLES [BUSES]

HS-022 545

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION

HS-022 542

## **PRACTICAL**

PRACTICAL ASPECTS OF TESTING ANTI-LOCK SYSTEMS ON COMMERCIAL VEHICLES

HS-022 579

## **PRECISION**

PRECISION POSITION-SENSORS IN AUTOMOTIVE APPLICATIONS

HS-022 560

## **PRELIMINARY**

COMPILATION OF REPORTS GENERATED BY THE TIRE SYSTEMS DIVISION, SAFETY RESEARCH LABORATORY, 1967 THRU JANUARY 1978. PRELIMINARY REPORT

HS-803 312

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY

FIELD PERFORMANCE EVALUATION--PROGRESS REPORT

HS-022 625

## **PREPARATION**

THE EFFECT OF MIXTURE PREPARATION ON FUEL ECONOMY

HS-022 666

THE 1979 ESTIMATE OF THE COST OF COMPLETING THE INTERSTATE SYSTEM. INSTRUCTION MANUAL FOR PREPARATION AND SUBMISSION

HS-022 553

## **PRESS**

STATEMENT AT THE NATIONAL PRESS CLUB, WASHINGTON, D.C., THURSDAY, SEPT. 1, 1977

HS-810 314

## **PRESSURE**

AIR BRAKING SYSTEMS WITH INCREASED PRESSURE

HS-022 598

THE FIRST PRODUCTION AUTOMOTIVE CAPACITIVE PRESSURE SENSOR

HS-022 565

## **PRIMER**

A PRIMER ON FORMING ALUMINUM SHEET

HS-022 655

## **PRINCIPLES**

BASIC PRINCIPLES [VEHICLE BRAKING]

HS-022 567

PRINCIPLES GOVERNING FUEL ECONOMY IN A GASOLINE ENGINE

HS-022 662

## **PRODUCED**

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OCTOBER TO 31 OCTOBER 1977

HS-803 313

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 9, 1 NOVEMBER TO 30 NOVEMBER 1977

HS-803 318

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 10, 1 DECEMBER TO 31 DECEMBER 1977

HS-803 319

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978

HS-803 320

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978

HS-803 321

## **PRODUCTION**

DESIGN INNOVATIONS FACILITATING ECONOMIC PRODUCTION OF GIANT MOULDINGS

HS-022 552

THE FIRST PRODUCTION AUTOMOTIVE CAPACITIVE PRESSURE SENSOR

HS-022 565

## PROGRAMMING

EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING ISSUES, TECHNIQUES, AND THEIR RELATIONSHIPS

HS-022 550

## PROJECTS

REPAIR INDUSTRY RESPONSE TO DIAGNOSTIC INSPECTION PROJECTS

HS-022 516

## PROPERTIES

DYNAMIC CORNERING PROPERTIES OF TIRES

HS-022 607

MEASUREMENTS OF THE LONGITUDINAL AND LATERAL TRACTION PROPERTIES OF TRUCK TIRES

HS-022 576

THE EFFECT OF THE PHYSICAL PROPERTIES OF GASOLINE ON FUEL ECONOMY

HS-022 664

## PROSPECTS

PROSPECTS FOR BUS AND COACH TRANSPORT [UNITED KINGDOM]

HS-022 528

## PROTECTION

ANTI-CORROSIVE PROTECTION OF CARS

HS-022 660

PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS] OCCUPANTS IN FRONTAL IMPACTS

HS-022 546

## PROTOCOL

NECK INJURY ASSESSMENT PROTOCOL. FINAL REPORT

HS-803 287

## PSV

DESIGN, CONSTRUCTION AND APPLICATION OF AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE] SUSPENSION [BUSES]

HS-022 533

ENVIRONMENTAL REQUIREMENTS FOR PSV [PUBLIC SERVICE VEHICLE] OPERATION [BUSES]

HS-022 530

INVESTIGATION OF PSV [PUBLIC SERVICE VEHICLE] ROLL OVER SAFETY [BUSES]

HS-022 535

THE NATIONAL PSV [PUBLIC SERVICE VEHICLE] ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED STUDY [BUSES]

HS-022 544

## PUBLIC

A DESIGN AND EVALUATION STUDY OF HANDHOLDS AND FOOTHOLDS FOR EMERGENCY WINDOWS OF CLASS III PUBLIC SERVICE VEHICLES [BUSES]

HS-022 529

ALLISON AUTOMATIC TRANSMISSIONS FOR PUBLIC SERVICE VEHICLES [BUSES]

HS-022 538

DESIGN, CONSTRUCTION AND APPLICATION OF AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE] SUSPENSION [BUSES]

HS-022 533

ENVIRONMENTAL REQUIREMENTS FOR PSV [PUBLIC SERVICE VEHICLE] OPERATION [BUSES]

HS-022 530

HYDRAULIC SUSPENSIONS WITH PARTICULAR REFERENCE TO PUBLIC SERVICE VEHICLES [BUSES]

HS-022 534

INVESTIGATION OF PSV [PUBLIC SERVICE VEHICLE] ROLL OVER SAFETY [BUSES]

HS-022 535

POWER TRAIN ENGINEERING FOR PUBLIC SERVICE VEHICLES [BUSES]

HS-022 545

PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS] OCCUPANTS IN FRONTAL IMPACTS

HS-022 546

STATUTORY TECHNICAL CONTROL OF PUBLIC SERVICE VEHICLES [BUSES] [UNITED KINGDOM]

HS-022 531

THE CHOICE OF MATERIALS IN THE DESIGN AND CONSTRUCTION OF PUBLIC SERVICE VEHICLES [BUSES]

HS-022 541

THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977

HS-022 527

THE NATIONAL PSV [PUBLIC SERVICE VEHICLE] ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED STUDY [BUSES]

HS-022 544

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION

HS-022 542

## PUMPS

WINDSHIELD WASH SYSTEMS AND THEIR PUMPS

HS-022 658

## QUALITY

WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS FOR STATE, REGIONAL, AND LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

## RADAR

TARGET IDENTIFICATION CAPABILITY OF SWEEPED FREQUENCY AUTOMOBILE RADAR

HS-022 613

## RADIAL

SOURCES OF ROLLING RESISTANCE IN RADIAL PLY TIRES

HS-022 612

August 31, 1978

## **RADIO**

HIGHWAY ADVISORY RADIO IN CONSTRUCTION  
AREAS. FINAL REPORT

HS-022 697

## **RAILROAD**

CRASH SAFETY FOR RAILROAD PASSENGERS,  
TRAIN CREWS AND GRADE CROSSING CRASH VIC-  
TIMS

HS-022 514

## **RANGE**

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE  
WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST  
OF ELECTRIC VEHICLES

HS-022 611

## **RANKINE**

AN ASSESSMENT OF THE TECHNOLOGY OF RAN-  
KINE ENGINES FOR AUTOMOBILES

HS-022 647

## **RATE**

DEVELOPMENT OF A BICYCLE ACCIDENT RATE IN  
ARIZONA

HS-022 636

## **RATES**

ACCIDENT RATES VS SHOULDER WIDTHS. FINAL  
REPORT

HS-022 525

## **RATIO**

A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR

HS-022 563

MOTOR GASOLINE AND THE EFFECT OF COMPRES-  
SION RATIO ON OCTANE REQUIREMENT AND FUEL  
ECONOMY

HS-022 663

## **REANALYSIS**

A REANALYSIS OF CALIFORNIA DRIVER VISION  
DATA: GENERAL FINDINGS

HS-022 675

## **REAR**

RECOGNITION DISTANCES OF VEHICLE REAR  
MARKINGS AT NIGHT

HS-022 689

## **RECENT**

RECENT PROGRESS IN BRAKING TESTS BY USE OF  
A CAR DYNAMOMETER

HS-022 583

## **RECOGNITION**

RECOGNITION DISTANCES OF VEHICLE REAR  
MARKINGS AT NIGHT

HS-022 689

## **RECORDING**

A DATA RECORDING SYSTEM OF THE PATH OF A  
TEST VEHICLE BY LASER BEAM AND SOME APPLI-  
CATIONS TO STEERING HANDLING TEST

HS-022 520

## **REDUCING**

PLANNING FOR THE AUTOMOBILE IN THE SCAG  
[SOUTHERN CALIFORNIA ASSOCIATION OF  
GOVERNMENTS] REGION. AN EVALUATION OF AL-

TERNATIVES FOR REDUCING AUTOMOBILE EMIS-  
SIONS AND FUEL CONSUMPTION

HS-022 650

## **REDUCTION**

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY  
SURVEY AND RELAY ALTERNATIVES. FINAL RE-  
PORT

HS-022 691

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE  
AND RELAY DEVICES AND TECHNIQUES. FINAL  
REPORT

HS-022 692

## **REFERENCE**

HYDRAULIC SUSPENSIONS WITH PARTICULAR  
REFERENCE TO PUBLIC SERVICE VEHICLES  
[BUSES]

HS-022 534

## **REGARDING**

A COMPARISON OF ADVANCED BELT SYSTEMS RE-  
GARDING THEIR EFFECTIVENESS

HS-022 623

## **REGION**

PLANNING FOR THE AUTOMOBILE IN THE SCAG  
[SOUTHERN CALIFORNIA ASSOCIATION OF  
GOVERNMENTS] REGION. AN EVALUATION OF AL-  
TERNATIVES FOR REDUCING AUTOMOBILE EMIS-  
SIONS AND FUEL CONSUMPTION

HS-022 650

## **REGIONAL**

WORKSHOPS ON TRANSPORTATION-AIR QUALITY.  
RESEARCH NEEDS FOR STATE, REGIONAL, AND  
LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

## **REGULATIONS**

BRAKING REGULATIONS IN EUROPE

HS-022 596

## **REHABILITATION**

INTERIM ANALYSIS OF STR [SHORT TERM REHA-  
BILITATION] PERFORMANCE AND EFFECTIVENESS.  
TWELVE-MONTH ANALYSES

HS-803 285

## **RELATIONSHIP**

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE  
WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST  
OF ELECTRIC VEHICLES

HS-022 611

## **RELATIONSHIPS**

EVALUATING OPTIONS IN STATEWIDE TRANSPOR-  
TATION PLANNING/PROGRAMMING ISSUES,  
TECHNIQUES, AND THEIR RELATIONSHIPS

HS-022 550

## **RELATIVE**

THE RELATIVE MERITS OF DIFFERENT LOW BEAM  
HEADLIGHTING SYSTEMS - A REVIEW OF THE  
LITERATURE. FINAL REPORT

HS-022 704

**RELAY**

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT

HS-022 691

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE AND RELAY DEVICES AND TECHNIQUES. FINAL REPORT

HS-022 692

**RELIABILITY**

RELIABILITY AND MAINTAINABILITY OF BRAKING SYSTEMS--MILITARY APPLICATIONS

HS-022 594

RELIABILITY, MAINTAINABILITY, SAFETY AND HUMAN FACTOR (RMSH) CONSIDERATIONS IN THE AUTOMOTIVE INDUSTRY

HS-022 519

THEORY OF RELIABILITY AND ITS APPLICATION TO VEHICLE BRAKES AND BRAKING SYSTEMS

HS-022 593

**REPAIR**

OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES

HS-022 590

REPAIR INDUSTRY RESPONSE TO DIAGNOSTIC INSPECTION PROJECTS

HS-022 516

**REQUIREMENT**

MOTOR GASOLINE AND THE EFFECT OF COMPRESSION RATIO ON OCTANE REQUIREMENT AND FUEL ECONOMY

HS-022 663

**REQUIREMENTS**

AN INTERVIEW SURVEY OF MOTORWAY DRIVER INFORMATION REQUIREMENTS AND SIGNAL UNDERSTANDING

HS-022 673

BASIC REQUIREMENTS FOR URBAN CARS

HS-022 610

ENVIRONMENTAL REQUIREMENTS FOR PSV [PUBLIC SERVICE VEHICLE] OPERATION [BUSES]

HS-022 530

OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES

HS-022 590

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION

HS-022 542

**RESEARCH**

BUS RESEARCH AND DEVELOPMENT AT AUTOKUT RESEARCH INSTITUTE, HUNGARY

HS-022 540

COMPILATION OF REPORTS GENERATED BY THE TIRE SYSTEMS DIVISION, SAFETY RESEARCH LABORATORY, 1967 THRU JANUARY 1978. PRELIMINARY REPORT

HS-803 312

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM

HS-022 701

PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY

HS-022 626

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 1: EXECUTIVE SUMMARY. FINAL REPORT

HS-803 249

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2: COMPREHENSIVE TECHNICAL RESULTS. FINAL REPORT

HS-803 250

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3A: SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 251

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3B: SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 252

THE USE OF THE MOBILE TIRE TRACTION DYNAMOMETER IN RESEARCH

HS-022 609

WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS FOR STATE, REGIONAL, AND LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

**RESISTANCE**

SOURCES OF ROLLING RESISTANCE IN RADIAL PLY TIRES

HS-022 612

**RESPONSE**

REPAIR INDUSTRY RESPONSE TO DIAGNOSTIC INSPECTION PROJECTS

HS-022 516

**RESPONSES**

THE COVERT RESPONSES OF DRIVERS TO TWO ROAD BASED ALERTING DEVICES

HS-022 680

**RESPONSIBLE**

THE SOCIALLY RESPONSIBLE CAR

HS-022 526

**RESTRAINT**

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT

HS-022 625

**RESTRICTIONS**

A STUDY OF MALE MOTORISTS' ATTITUDES TO SPEED RESTRICTIONS AND THEIR ENFORCEMENT

HS-022 682

August 31, 1978

## RESULTS

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2:  
COMPREHENSIVE TECHNICAL RESULTS. FINAL RE-  
PORT

HS-803 250

## REVIEW

A REVIEW OF COMMERCIAL VEHICLE BRAKES

HS-022 599

BRAKES--A REVIEW OF EXISTING DESIGN

HS-022 582

REVIEW OF BRAKING LEGISLATION IN BRITAIN  
DURING THE PAST DECADE

HS-022 597

THE RELATIVE MERITS OF DIFFERENT LOW BEAM  
HEADLIGHTING SYSTEMS - A REVIEW OF THE  
LITERATURE. FINAL REPORT

HS-022 704

## RIGID

BRAKING SYSTEMS FOR RIGID VEHICLES

HS-022 568

NON-RIGID VEHICLE BRAKING SYSTEMS

HS-022 569

## RMSH

RELIABILITY, MAINTAINABILITY, SAFETY AND  
HUMAN FACTOR (RMSH) CONSIDERATIONS IN THE  
AUTOMOTIVE INDUSTRY

HS-022 519

## ROAD

A STUDY OF ROAD ACCIDENTS IN SELECTED  
URBAN AREAS IN DEVELOPING COUNTRIES

HS-022 676

BRAKING OF ROAD VEHICLES. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIVISION, IN AS-  
SOCIATION WITH THE INSTITUTE OF ROAD TRANS-  
PORT ENGINEERS, LOUGHBOROUGH UNIVERSITY  
OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

DEATH AND INJURY ROAD ACCIDENTS IN  
NORTHERN IRELAND 1976

HS-022 693

DEFECTS IN ROAD VEHICLE BRAKING SYSTEMS--  
EXPERIENCE FROM STATUTORY INSPECTIONS

HS-022 592

LATERAL STABILITY OF COMMERCIAL ROAD VEHI-  
CLE TRAINS UNDER BRAKING CONDITIONS

HS-022 570

ROAD ACCIDENTS AS A CAUSE OF DEATH IN  
DEVELOPING COUNTRIES

HS-022 683

THE COVERT RESPONSES OF DRIVERS TO TWO  
ROAD BASED ALERTING DEVICES

HS-022 680

THE EFFECT OF VEHICLE AND ROAD CHARAC-  
TERISTICS ON COMMERCIAL VEHICLE SPEEDS IN  
ETHIOPIA

HS-022 681

THE TYRE/ROAD [TIRE/ROAD] INTERFACE--ITS EF-  
FECT ON BRAKING

HS-022 574

WET FRICTION--TYRE [TIRE] AND ROAD [BRAKING]

HS-022 575

## ROLL

INVESTIGATION OF PSV [PUBLIC SERVICE VEHI-  
CLE] ROLL OVER SAFETY [BUSES]

HS-022 535

## ROLLING

SOURCES OF ROLLING RESISTANCE IN RADIAL  
PLY TIRES

HS-022 612

## ROTOR

CAST IRON BRAKE ROTOR METALLURGY

HS-022 581

## RUMBLE

THE DEVELOPMENT OF RUMBLE AREAS AS A  
DRIVER ALERTING DEVICE

HS-022 686

## SCAG

PLANNING FOR THE AUTOMOBILE IN THE SCAG  
[SOUTHERN CALIFORNIA ASSOCIATION OF  
GOVERNMENTS] REGION. AN EVALUATION OF AL-  
TERNATIVES FOR REDUCING AUTOMOBILE EMIS-  
SIONS AND FUEL CONSUMPTION

HS-022 650

## SCALE

A SCALE MODEL SIMULATION OF VEHICLE MO-  
TIONS

HS-022 606

## SCHOOL

THE DESIGN, CONSTRUCTION AND OPERATION OF  
PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIV., AND SCHOOL  
OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977

HS-022 527

## SCIENCE

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR  
BIOSCIENCES RESEARCH: FINAL TECHNICAL  
LETTER REPORT ON NSF [NATIONAL SCIENCE  
FOUNDATION] PROGRAM

HS-022 701

## SCREENING

EVALUATION OF SCREENING BREATH TESTING IN  
TRAFFIC LAW ENFORCEMENT. FINAL REPORT

HS-803 274

FACTOR STRUCTURE OF THE MICHIGAN ALCOHOL-  
ISM SCREENING TEST

HS-022 648

## SEAT

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE  
BOLSTER RESTRAINT, VWRA--A PRELIMINARY  
FIELD PERFORMANCE EVALUATION--PROGRESS  
REPORT

HS-022 625

## SECTION

ALTERNATIVE FUELS FOR AUTOMOTIVE TRANS-  
PORTATION --A FEASIBILITY STUDY. VOL. 2--  
TECHNICAL SECTION

HS-022 644



## SELECTION

SELECTION OF PEDESTRIAN SIGNAL PHASING  
HS-022 627

## SENSING

ACCIDENTS TO ARTICULATED VEHICLES FITTED  
WITH LOAD SENSING OR ANTI-LOCKING BRAKES  
TO COUNTERACT JACK-KNIFING  
HS-022 677

## SENSOR

A WORLDWIDE OVERVIEW OF AUTOMOTIVE EN-  
GINE CONTROL SENSOR TECHNOLOGY  
HS-022 558

A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR  
HS-022 563

APPLICATION OF A CRANKSHAFT POSITION SEN-  
SOR TO CONTROL ENGINE TIMING  
HS-022 564

THE FIRST PRODUCTION AUTOMOTIVE CAPACI-  
TIVE PRESSURE SENSOR  
HS-022 565

## SENSORS

APPLICATION OF AUTOMOTIVE SENSORS TO EN-  
GINE CONTROL  
HS-022 561

AUTOMOTIVE APPLICATIONS OF SENSORS  
HS-022 557

PRECISION POSITION-SENSORS IN AUTOMOTIVE  
APPLICATIONS  
HS-022 560

TEMPERATURE SENSORS FOR ELECTRONIC EN-  
GINE CONTROL SYSTEMS  
HS-022 562

## SERIES

ENGINE DESIGN SERIES: FUEL SYSTEMS--DIESEL  
HS-022 659

## SERVICE

A DESIGN AND EVALUATION STUDY OF HAND-  
HOLDS AND FOOTHOLDS FOR EMERGENCY WIN-  
DOWS OF CLASS III PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 529

ALLISON AUTOMATIC TRANSMISSIONS FOR  
PUBLIC SERVICE VEHICLES [BUSES]  
HS-022 538

DESIGN, CONSTRUCTION AND APPLICATION OF  
AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE]  
SUSPENSION [BUSES]  
HS-022 533

ENVIRONMENTAL REQUIREMENTS FOR PSV  
[PUBLIC SERVICE VEHICLE] OPERATION [BUSES]  
HS-022 530

HYDRAULIC SUSPENSIONS WITH PARTICULAR  
REFERENCE TO PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 534

INVESTIGATION OF PSV [PUBLIC SERVICE VEHI-  
CLE] ROLL OVER SAFETY [BUSES]  
HS-022 535

POWER TRAIN ENGINEERING FOR PUBLIC SERVICE  
VEHICLES [BUSES]  
HS-022 545

PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS]  
OCCUPANTS IN FRONTAL IMPACTS  
HS-022 546

STATUTORY TECHNICAL CONTROL OF PUBLIC  
SERVICE VEHICLES [BUSES] [UNITED KINGDOM]  
HS-022 531

THE CHOICE OF MATERIALS IN THE DESIGN AND  
CONSTRUCTION OF PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 541

THE DESIGN, CONSTRUCTION AND OPERATION OF  
PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIV., AND SCHOOL  
OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977  
HS-022 527

THE NATIONAL PSV [PUBLIC SERVICE VEHICLE]  
ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED  
STUDY [BUSES]  
HS-022 544

THE OPERATORS' PERFORMANCE REQUIREMENTS  
FOR POWER UNITS AND TRANSMISSION SYSTEMS  
FOR PUBLIC SERVICE VEHICLES [BUSES] IN  
URBAN OPERATION  
HS-022 542

## SETTINGS

FEASIBILITY OF DETERMINING BLOOD ALCOHOL  
CONCENTRATIONS IN SOCIAL DRINKING SETTINGS  
HS-022 649

## SHEET

A PRIMER ON FORMING ALUMINUM SHEET  
HS-022 655

TESTS CONFIRM FORMABILITY OF DUAL-PHASE,  
HIGH-STRENGTH STEEL SHEET  
HS-022 653

## SHORT

INTERIM ANALYSIS OF STR [SHORT TERM REHA-  
BILITATION] PERFORMANCE AND EFFECTIVENESS.  
TWELVE-MONTH ANALYSES  
HS-803 285

## SHOULDER

ACCIDENT RATES VS SHOULDER WIDTHS. FINAL  
REPORT  
HS-022 525

## SIGNAL

AN INTERVIEW SURVEY OF MOTORWAY DRIVER  
INFORMATION REQUIREMENTS AND SIGNAL UN-  
DERSTANDING  
HS-022 673

PEDESTRIAN DELAY AND PEDESTRIAN SIGNAL  
WARRANTS  
HS-022 628

PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION  
OF WORD MESSAGE AND OPERATION  
HS-022 630

SELECTION OF PEDESTRIAN SIGNAL PHASING  
HS-022 627

August 31, 1978

STUDY OF MOTOR VEHICLE SIGNAL SYSTEMS.  
FINAL REPORT

HS-022 690

## **SIGNALIZATION**

TRAFFIC SIGNALIZATION SYSTEMS

HS-022 556

## **SIGNIFICANT**

SOME SIGNIFICANT DEVELOPMENTS IN AIR  
BRAKE SYSTEM COMPONENTS

HS-022 580

## **SIMULATION**

A SCALE MODEL SIMULATION OF VEHICLE MO-  
TIONS

HS-022 606

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY  
UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS TECHNIQUES

HS-022 621

USING COMPUTER SIMULATION TO EVALUATE  
AND IMPROVE VEHICLE HANDLING

HS-022 513

## **SIMULATOR**

THE EFFECT OF SURGICAL OPERATION ON THE  
'BRAKE-CLUTCH SIMULATOR'

HS-022 589

## **SIZED**

CONSUMER ACCEPTANCE OF DOWN-SIZED AU-  
TOMOBILES

HS-022 523

## **SKILL**

SKILL TRAINING FOR COLLISION AVOIDANCE

HS-022 640

## **SLIP**

THE INFLUENCE OF WHEEL SLIP CONTROL  
DYNAMICS ON VEHICLE STABILITY DURING BRAK-  
ING AND STEERING

HS-022 573

## **SMALLER**

PASSIVE VEHICLE SAFETY AS CARS GROW  
SMALLER

HS-022 617

## **SOCIAL**

FEASIBILITY OF DETERMINING BLOOD ALCOHOL  
CONCENTRATIONS IN SOCIAL DRINKING SETTINGS

HS-022 649

## **SOCIALLY**

THE SOCIALLY RESPONSIBLE CAR

HS-022 526

## **SOLID**

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE  
AND RELAY DEVICES AND TECHNIQUES. FINAL  
REPORT

HS-022 692

## **SOURCES**

SOURCES OF ROLLING RESISTANCE IN RADIAL  
PLY TIRES

HS-022 612

## **SOUTHERN**

MEASURING THE OUTCOMES OF DRIVER TRAIN-  
ING: UNIVERSITY OF SOUTHERN CALIFORNIA  
DRIVER PERFORMANCE TEST

HS-022 639

PLANNING FOR THE AUTOMOBILE IN THE SCAG  
[SOUTHERN CALIFORNIA ASSOCIATION OF  
GOVERNMENTS] REGION. AN EVALUATION OF AL-  
TERNATIVES FOR REDUCING AUTOMOBILE EMIS-  
SIONS AND FUEL CONSUMPTION

HS-022 650

## **SPACE**

THE NASA [NATIONAL AERONAUTICS AND SPACE  
ADMINISTRATION] NASTRAN STRUCTURAL ANAL-  
YSIS COMPUTER PROGRAM--NEW CONTENT

HS-022 521

## **SPECIFIC**

VEHICLE TYPES IN RELATION TO SPECIFIC  
OPERATING CONDITIONS [UNITED KINGDOM]  
[BUSES]

HS-022 536

## **SPEED**

A STUDY OF MALE MOTORISTS' ATTITUDES TO  
SPEED RESTRICTIONS AND THEIR ENFORCEMENT

HS-022 682

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR  
BIOSCIENCES RESEARCH: FINAL TECHNICAL  
LETTER REPORT ON NSF [NATIONAL SCIENCE  
FOUNDATION] PROGRAM

HS-022 701

## **SPEEDS**

THE EFFECT OF VEHICLE AND ROAD CHARAC-  
TERISTICS ON COMMERCIAL VEHICLE SPEEDS IN  
ETHIOPIA

HS-022 681

## **SPONSORED**

BRAKING OF ROAD VEHICLES. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIVISION, IN AS-  
SOCIATION WITH THE INSTITUTE OF ROAD TRANS-  
PORT ENGINEERS, LOUGHBOROUGH UNIVERSITY  
OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

THE DESIGN, CONSTRUCTION AND OPERATION OF  
PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIV., AND SCHOOL  
OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND,  
11-13 JUL 1977

HS-022 527

## **SPOT**

ACCIDENTS INVOLVING LOSS OF CONTROL WHEN  
BRAKING - A STUDY OF THE ON-THE-SPOT SURVEY  
DATA

HS-022 588

**SPRINGS**  
DESIGN, CONSTRUCTION AND APPLICATION OF  
AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE]  
SUSPENSION [BUSES]

HS-022 533

**SQUEAL**

A THEORY OF DRUM BRAKE SQUEAL

HS-022 585

DISC BRAKE SQUEAL

HS-022 584

**STABILITY**

LATERAL STABILITY OF COMMERCIAL ROAD VEHICLE  
TRAINS UNDER BRAKING CONDITIONS

HS-022 570

THE INFLUENCE OF WHEEL SLIP CONTROL  
DYNAMICS ON VEHICLE STABILITY DURING BRAKING  
AND STEERING

HS-022 573

THE STABILITY OF MOTORCYCLES IN ACCELERATION  
AND DECELERATION

HS-022 571

**STANDARD**

NEW STANDARD BUS EQUIPMENT

HS-022 555

**STATEMENT**

STATEMENT AT THE NATIONAL PRESS CLUB,  
WASHINGTON, D.C., THURSDAY, SEPT. 1, 1977

HS-810 314

**STATES**

OVERVIEW OF ELECTRIC VEHICLES IN THE  
UNITED STATES

HS-022 522

**STATEWIDE**

EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION  
PLANNING/PROGRAMMING ISSUES,  
TECHNIQUES, AND THEIR RELATIONSHIPS

HS-022 550

**STATUTORY**

DEFECTS IN ROAD VEHICLE BRAKING SYSTEMS--  
EXPERIENCE FROM STATUTORY INSPECTIONS

HS-022 592

STATUTORY TECHNICAL CONTROL OF PUBLIC  
SERVICE VEHICLES [BUSES] [UNITED KINGDOM]

HS-022 531

**STEEL**

TESTS CONFIRM FORMABILITY OF DUAL-PHASE,  
HIGH-STRENGTH STEEL SHEET

HS-022 653

**STEERING**

A DATA RECORDING SYSTEM OF THE PATH OF A  
TEST VEHICLE BY LASER BEAM AND SOME APPLICATIONS  
TO STEERING HANDLING TEST

HS-022 520

THE INFLUENCE OF WHEEL SLIP CONTROL  
DYNAMICS ON VEHICLE STABILITY DURING BRAKING  
AND STEERING

HS-022 573

**STILL**

ARE PEOPLE STILL GETTING BIGGER--WHO,  
WHERE, AND HOW MUCH? [DESIGN OF AUTOMOTIVE  
EQUIPMENT]

HS-022 616

**STR**

INTERIM ANALYSIS OF STR [SHORT TERM REHABILITATION]  
PERFORMANCE AND EFFECTIVENESS.  
TWELVE-MONTH ANALYSES

HS-803 285

**STRENGTH**

TESTS CONFIRM FORMABILITY OF DUAL-PHASE,  
HIGH-STRENGTH STEEL SHEET

HS-022 653

THE ADHESIVE TESTING OF HIGH STRENGTH  
LAMINATES FOR STRUCTURAL DURABILITY

HS-022 678

**STRUCTURAL**

DESIGN CONSIDERATIONS IN ENERGY ABSORPTION  
BY STRUCTURAL COLLAPSE

HS-022 624

ENERGY ABSORPTION BY THE PLASTIC DEFORMATION  
OF BODY STRUCTURAL MEMBERS

HS-022 622

THE ADHESIVE TESTING OF HIGH STRENGTH  
LAMINATES FOR STRUCTURAL DURABILITY

HS-022 678

THE NASA [NATIONAL AERONAUTICS AND SPACE  
ADMINISTRATION] NASTRAN STRUCTURAL ANALYSIS  
COMPUTER PROGRAM--NEW CONTENT

HS-022 521

**STRUCTURE**

FACTOR STRUCTURE OF THE MICHIGAN ALCOHOLISM  
SCREENING TEST

HS-022 648

**SUBCONTRACTOR**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3A:  
SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 251

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3B:  
SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 252

**SUBMISSION**

THE 1979 ESTIMATE OF THE COST OF COMPLETING  
THE INTERSTATE SYSTEM. INSTRUCTION MANUAL  
FOR PREPARATION AND SUBMISSION

HS-022 553

**SUBSTITUTE**

EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS.  
MONTHLY PROGRESS REPORT NO. 8, 1 OCTOBER TO 31  
OCTOBER 1977

HS-803 313

EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS.  
MONTHLY PROGRESS REPORT NO. 9, 1 NOVEMBER TO 30  
NOVEMBER 1977

HS-803 318

EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING COM-

August 31, 1978

POUNDS. MONTHLY PROGRESS REPORT NO. 10, 1  
DECEMBER TO 31 DECEMBER 1977

HS-803 319

EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING COM-  
POUNDS. MONTHLY PROGRESS REPORT NO. 11, 1  
JANUARY TO 31 JANUARY 1978

HS-803 320

EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING COM-  
POUNDS. MONTHLY PROGRESS REPORT NO. 12, 1  
FEBRUARY TO 28 FEBRUARY 1978

HS-803 321

## **SURGICAL**

THE EFFECT OF SURGICAL OPERATION ON THE  
'BRAKE-CLUTCH SIMULATOR'

HS-022 589

## **SURVEY**

ACCIDENTS INVOLVING LOSS OF CONTROL WHEN  
BRAKING - A STUDY OF THE ON-THE-SPOT SURVEY  
DATA

HS-022 588

AN INTERVIEW SURVEY OF MOTORWAY DRIVER  
INFORMATION REQUIREMENTS AND SIGNAL UN-  
DERSTANDING

HS-022 673

HOW PASSENGER CAR MAINTENANCE AFFECTS  
FUEL ECONOMY AND EMISSIONS. A NATIONWIDE  
SURVEY

HS-022 517

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY  
SURVEY AND RELAY ALTERNATIVES. FINAL RE-  
PORT

HS-022 691

THE NATIONAL PSV (PUBLIC SERVICE VEHICLE)  
ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED  
STUDY [BUSES]

HS-022 544

## **SUSPENSION**

DESIGN, CONSTRUCTION AND APPLICATION OF  
AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE]  
SUSPENSION [BUSES]

HS-022 533

## **SUSPENSIONS**

HYDRAULIC SUSPENSIONS WITH PARTICULAR  
REFERENCE TO PUBLIC SERVICE VEHICLES  
[BUSES]

HS-022 534

## **SWEPT**

TARGET IDENTIFICATION CAPABILITY OF SWEPT  
FREQUENCY AUTOMOBILE RADAR

HS-022 613

## **SYNTHESIS**

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY  
UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS  
TECHNIQUES

HS-022 621

## **TARGET**

TARGET IDENTIFICATION CAPABILITY OF SWEPT  
FREQUENCY AUTOMOBILE RADAR

HS-022 613

THE TARGET CAR PROGRAM FOR 1977

HS-022 603

## **TASK**

FEASIBILITY TEST ON COMPOUNDING THE INTER-  
NAL COMBUSTION ENGINE FOR AUTOMOTIVE  
VEHICLES, TASK 2. FINAL REPORT

HS-022 646

## **TECHNOLOGY**

A WORLDWIDE OVERVIEW OF AUTOMOTIVE EN-  
GINE CONTROL SENSOR TECHNOLOGY

HS-022 558

AN ASSESSMENT OF THE TECHNOLOGY OF RAN-  
KINE ENGINES FOR AUTOMOBILES

HS-022 647

BRAKING OF ROAD VEHICLES. CONFERENCE  
SPONSORED BY THE INSTITUTION OF MECHANICAL  
ENGINEERS, AUTOMOBILE DIVISION, IN AS-  
SOCIATION WITH THE INSTITUTE OF ROAD TRANS-  
PORT ENGINEERS, LOUGHBOROUGH UNIVERSITY  
OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY  
SURVEY AND RELAY ALTERNATIVES. FINAL RE-  
PORT

HS-022 691

## **TEMPERATURE**

TEMPERATURE SENSORS FOR ELECTRONIC EN-  
GINE CONTROL SYSTEMS

HS-022 562

## **TERM**

INTERIM ANALYSIS OF STR [SHORT TERM REHA-  
BILITATION] PERFORMANCE AND EFFECTIVENESS.  
TWELVE-MONTH ANALYSES

HS-803 285

## **TEST**

A DATA RECORDING SYSTEM OF THE PATH OF A  
TEST VEHICLE BY LASER BEAM AND SOME APPLI-  
CATIONS TO STEERING HANDLING TEST

HS-022 520

EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING COM-  
POUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OC-  
TOBER TO 31 OCTOBER 1977

HS-803 313

EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING COM-  
POUNDS. MONTHLY PROGRESS REPORT NO. 9, 1  
NOVEMBER TO 30 NOVEMBER 1977

HS-803 318

EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING COM-  
POUNDS. MONTHLY PROGRESS REPORT NO. 10, 1  
DECEMBER TO 31 DECEMBER 1977

HS-803 319

EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978	HS-803 320	THE TYRE/ROAD [TIRE/ROAD] INTERFACE--ITS EFFECT ON BRAKING	HS-022 574
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978	HS-803 321	THE USE OF THE MOBILE TIRE TRACTION DYNAMOMETER IN RESEARCH	HS-022 609
FACTOR STRUCTURE OF THE MICHIGAN ALCOHOLISM SCREENING TEST	HS-022 648	WET FRICTION--TYRE [TIRE] AND ROAD [BRAKING]	HS-022 575
FEASIBILITY TEST ON COMPOUNDING THE INTERNAL COMBUSTION ENGINE FOR AUTOMOTIVE VEHICLES, TASK 2. FINAL REPORT	HS-022 646	<b>TIRES</b>	
MEASURING THE OUTCOMES OF DRIVER TRAINING: UNIVERSITY OF SOUTHERN CALIFORNIA DRIVER PERFORMANCE TEST	HS-022 639	DYNAMIC CORNERING PROPERTIES OF TIRES	HS-022 607
TEST AND EVALUATION OF 23 ELECTRIC VEHICLES FOR STATE-OF-THE-ART ASSESSMENT	HS-022 619	MEASUREMENTS OF THE LONGITUDINAL AND LATERAL TRACTION PROPERTIES OF TRUCK TIRES	HS-022 576
<b>TESTING</b>		SOURCES OF ROLLING RESISTANCE IN RADIAL PLY TIRES	HS-022 612
EVALUATION OF SCREENING BREATH TESTING IN TRAFFIC LAW ENFORCEMENT. FINAL REPORT	HS-803 274	THE EFFECT OF HYDROPLANING ON THE DYNAMIC CHARACTERISTICS OF CAR, TRUCK AND BUS TIRES	HS-022 608
PRACTICAL ASPECTS OF TESTING ANTI-LOCK SYSTEMS ON COMMERCIAL VEHICLES	HS-022 579	<b>TOOL</b>	
THE ADHESIVE TESTING OF HIGH STRENGTH LAMINATES FOR STRUCTURAL DURABILITY	HS-022 678	CYBERMAN--A HUMAN FACTORS DESIGN TOOL	HS-022 618
<b>TESTS</b>		<b>TOXIC</b>	
RECENT PROGRESS IN BRAKING TESTS BY USE OF A CAR DYNAMOMETER	HS-022 583	TOXIC GASES IN HEAVY DUTY DIESEL TRUCK CABS. FINAL REPORT	HS-022 696
TESTS CONFIRM FORMABILITY OF DUAL-PHASE, HIGH-STRENGTH STEEL SHEET	HS-022 653	<b>TRACTION</b>	
<b>THEORY</b>		MEASUREMENTS OF THE LONGITUDINAL AND LATERAL TRACTION PROPERTIES OF TRUCK TIRES	HS-022 576
A THEORY OF DRUM BRAKE SQUEAL	HS-022 585	THE USE OF THE MOBILE TIRE TRACTION DYNAMOMETER IN RESEARCH	HS-022 609
THEORY OF RELIABILITY AND ITS APPLICATION TO VEHICLE BRAKES AND BRAKING SYSTEMS	HS-022 593	<b>TRAFFIC</b>	
<b>THURSDAY</b>		EVALUATION OF SCREENING BREATH TESTING IN TRAFFIC LAW ENFORCEMENT. FINAL REPORT	HS-803 274
STATEMENT AT THE NATIONAL PRESS CLUB, WASHINGTON, D.C., THURSDAY, SEPT. 1, 1977	HS-810 314	MOTOR VEHICLE TRAFFIC ACCIDENTS 1976	HS-022 524
<b>TIMING</b>		TRAFFIC SIGNALIZATION SYSTEMS	HS-022 556
APPLICATION OF A CRANKSHAFT POSITION SENSOR TO CONTROL ENGINE TIMING	HS-022 564	<b>TRAIN</b>	
<b>TIRE</b>		CRASH SAFETY FOR RAILROAD PASSENGERS, TRAIN CREWS AND GRADE CROSSING CRASH VICTIMS	HS-022 514
COMPILATION OF REPORTS GENERATED BY THE TIRE SYSTEMS DIVISION, SAFETY RESEARCH LABORATORY, 1967 THRU JANUARY 1978. PRELIMINARY REPORT	HS-803 312	POWER TRAIN ENGINEERING FOR PUBLIC SERVICE VEHICLES [BUSES]	HS-022 545
		<b>TRAINING</b>	
		MEASURING THE OUTCOMES OF DRIVER TRAINING: UNIVERSITY OF SOUTHERN CALIFORNIA DRIVER PERFORMANCE TEST	HS-022 639
		SKILL TRAINING FOR COLLISION AVOIDANCE	HS-022 640

August 31, 1978

## **TRAINS**

LATERAL STABILITY OF COMMERCIAL ROAD VEHICLE TRAINS UNDER BRAKING CONDITIONS

HS-022 570

## **TRANSMISSION**

THE EFFECT OF TRANSMISSION LUBRICANTS ON FUEL ECONOMY

HS-022 671

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION

HS-022 542

## **TRANSMISSIONS**

ALLISON AUTOMATIC TRANSMISSIONS FOR PUBLIC SERVICE VEHICLES [BUSES]

HS-022 538

## **TRANSPORT**

BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

PROSPECTS FOR BUS AND COACH TRANSPORT [UNITED KINGDOM]

HS-022 528

## **TRANSPORTATION**

ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION--A FEASIBILITY STUDY. VOL. 1--EXECUTIVE SUMMARY

HS-022 643

ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION --A FEASIBILITY STUDY. VOL. 2--TECHNICAL SECTION

HS-022 644

BICYCLE TRANSPORTATION FOR DOWNTOWN WORK TRIPS: A CASE STUDY IN DAVIS, CALIFORNIA

HS-022 633

EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING ISSUES, TECHNIQUES, AND THEIR RELATIONSHIPS

HS-022 550

SYSTEM-SAFETY TECHNIQUES USEFUL FOR TRANSPORTATION SAFETY

HS-022 641

TRANSPORTATION FOR ELDERLY AND HANDICAPPED PERSONS

HS-022 554

WORKSHOPS ON TRANSPORTATION-AIR QUALITY RESEARCH NEEDS FOR STATE, REGIONAL, AND LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

## **TRIPS**

BICYCLE TRANSPORTATION FOR DOWNTOWN WORK TRIPS: A CASE STUDY IN DAVIS, CALIFORNIA

HS-022 633

## **TRUCK**

MEASUREMENTS OF THE LONGITUDINAL AND LATERAL TRACTION PROPERTIES OF TRUCK TIRES

HS-022 576

THE EFFECT OF HYDROPLANING ON THE DYNAMIC CHARACTERISTICS OF CAR, TRUCK AND BUS TIRES

HS-022 608

TOXIC GASES IN HEAVY DUTY DIESEL TRUCK CABS. FINAL REPORT

HS-022 696

## **TRUCKS**

ENERGY USE AND OTHER COMPARISONS BETWEEN DIESEL AND GASOLINE PICKUP TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977

HS-022 548

## **TYPES**

VEHICLE TYPES IN RELATION TO SPECIFIC OPERATING CONDITIONS [UNITED KINGDOM] [BUSES]

HS-022 536

## **TYRE**

THE TYRE/ROAD [TIRE/ROAD] INTERFACE--ITS EFFECT ON BRAKING

HS-022 574

WET FRICTION--TYRE [TIRE] AND ROAD [BRAKING]

HS-022 575

## **UNITED**

HEATING AND VENTILATING [OF BUSES] IN U.K. [UNITED KINGDOM]

HS-022 532

OVERVIEW OF ELECTRIC VEHICLES IN THE UNITED STATES

HS-022 522

PROSPECTS FOR BUS AND COACH TRANSPORT [UNITED KINGDOM]

HS-022 528

STATUTORY TECHNICAL CONTROL OF PUBLIC SERVICE VEHICLES [BUSES] [UNITED KINGDOM]

HS-022 531

VEHICLE TYPES IN RELATION TO SPECIFIC OPERATING CONDITIONS [UNITED KINGDOM] [BUSES]

HS-022 536

## **UNITS**

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION

HS-022 542

## **UNIVERSITY**

BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

MEASURING THE OUTCOMES OF DRIVER TRAINING: UNIVERSITY OF SOUTHERN CALIFORNIA DRIVER PERFORMANCE TEST

HS-022 639

## URBAN

A STUDY OF ROAD ACCIDENTS IN SELECTED URBAN AREAS IN DEVELOPING COUNTRIES

HS-022 676

ACCIDENT DATA BASE FOR URBAN PEDESTRIANS

HS-022 632

BASIC REQUIREMENTS FOR URBAN CARS

HS-022 610

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION

HS-022 542

## USAGE

EFFECT OF BICYCLE LANE USAGE ON VEHICLES IN THE ADJACENT LANE

HS-022 637

## USEFUL

SYSTEM-SAFETY TECHNIQUES USEFUL FOR TRANSPORTATION SAFETY

HS-022 641

## UTILIZING

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS TECHNIQUES

HS-022 621

## VEHICLE

'AWARE,' AN IN-VEHICLE VISUAL COMMUNICATION SYSTEM FOR DRIVERS

HS-022 685

A DATA RECORDING SYSTEM OF THE PATH OF A TEST VEHICLE BY LASER BEAM AND SOME APPLICATIONS TO STEERING HANDLING TEST

HS-022 520

A REVIEW OF COMMERCIAL VEHICLE BRAKES

HS-022 599

A SCALE MODEL SIMULATION OF VEHICLE MOTIONS

HS-022 606

A STATUS REPORT ON VEHICLE DETECTORS. FINAL REPORT

HS-022 698

BASIC PRINCIPLES [VEHICLE BRAKING]

HS-022 567

DEFECTS IN ROAD VEHICLE BRAKING SYSTEMS--EXPERIENCE FROM STATUTORY INSPECTIONS

HS-022 592

DESIGN, CONSTRUCTION AND APPLICATION OF AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE] SUSPENSION [BUSES]

HS-022 533

EFFICIENT VEHICLE PACKAGING WITH FRONT-WHEEL DRIVE

HS-022 604

ELECTRIC VEHICLE SYSTEMS FY 1978. ENVIRONMENTAL DEVELOPMENT PLAN

HS-022 645

ENVIRONMENTAL REQUIREMENTS FOR PSV [PUBLIC SERVICE VEHICLE] OPERATION [BUSES]

HS-022 530

INVESTIGATION OF PSV [PUBLIC SERVICE VEHICLE] ROLL OVER SAFETY [BUSES]

HS-022 535

LATERAL STABILITY OF COMMERCIAL ROAD VEHICLE TRAINS UNDER BRAKING CONDITIONS

HS-022 570

LEGISLATIVE CONTROL OF ARTICULATED VEHICLE BRAKING [EUROPE]

HS-022 595

MOTOR VEHICLE TRAFFIC ACCIDENTS 1976

HS-022 524

NON-RIGID VEHICLE BRAKING SYSTEMS

HS-022 569

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST OF ELECTRIC VEHICLES

HS-022 611

PASSIVE VEHICLE SAFETY AS CARS GROW SMALLER

HS-022 617

PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS] OCCUPANTS IN FRONTAL IMPACTS

HS-022 546

RECOGNITION DISTANCES OF VEHICLE REAR MARKINGS AT NIGHT

HS-022 689

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 1: EXECUTIVE SUMMARY. FINAL REPORT

HS-803 249

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2: COMPREHENSIVE TECHNICAL RESULTS. FINAL REPORT

HS-803 250

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3A: SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 251

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3B: SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 252

STUDY OF MOTOR VEHICLE SIGNAL SYSTEMS. FINAL REPORT

HS-022 690

THE EFFECT OF VEHICLE AND ROAD CHARACTERISTICS ON COMMERCIAL VEHICLE SPEEDS IN ETHIOPIA

HS-022 681

THE EFFECT OF VEHICLE MAINTENANCE ON FUEL ECONOMY

HS-022 667

THE INFLUENCE OF WHEEL SLIP CONTROL DYNAMICS ON VEHICLE STABILITY DURING BRAKING AND STEERING

HS-022 573

THE NATIONAL PSV [PUBLIC SERVICE VEHICLE] ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED STUDY [BUSES]

HS-022 544

August 31, 1978

THE 1980'S: CHALLENGES OF CHANGE CONFRONTING THE MOTOR VEHICLE AND FREEDOM OF MOBILITY

HS-022 547

THEORY OF RELIABILITY AND ITS APPLICATION TO VEHICLE BRAKES AND BRAKING SYSTEMS

HS-022 593

USING COMPUTER SIMULATION TO EVALUATE AND IMPROVE VEHICLE HANDLING

HS-022 513

VEHICLE TYPES IN RELATION TO SPECIFIC OPERATING CONDITIONS [UNITED KINGDOM] [BUSES]

HS-022 536

## VEHICLES

A DESIGN AND EVALUATION STUDY OF HANDHOLDS AND FOOTHOLDS FOR EMERGENCY WINDOWS OF CLASS III PUBLIC SERVICE VEHICLES [BUSES]

HS-022 529

ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING

HS-022 677

AIR BRAKING SYSTEMS FOR COMMERCIAL VEHICLES IN COMPLIANCE WITH THE EEC-DIRECTIVE 71/320 BRAKING

HS-022 602

ALLISON AUTOMATIC TRANSMISSIONS FOR PUBLIC SERVICE VEHICLES [BUSES]

HS-022 538

BRAKE PERFORMANCE AND COSTS--COMMERCIAL VEHICLES

HS-022 601

BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

BRAKING SYSTEMS FOR RIGID VEHICLES

HS-022 568

COMPUTER ANALYSIS OF ANTILOCK SYSTEM PERFORMANCE IN THE BRAKING OF COMMERCIAL VEHICLES

HS-022 578

DISC BRAKES FOR COMMERCIAL VEHICLES

HS-022 600

EFFECT OF BICYCLE LANE USAGE ON VEHICLES IN THE ADJACENT LANE

HS-022 637

FEASIBILITY TEST ON COMPOUNDING THE INTERNAL COMBUSTION ENGINE FOR AUTOMOTIVE VEHICLES, TASK 2. FINAL REPORT

HS-022 646

HYDRAULIC SUSPENSIONS WITH PARTICULAR REFERENCE TO PUBLIC SERVICE VEHICLES [BUSES]

HS-022 534

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST OF ELECTRIC VEHICLES

HS-022 611

OVERVIEW OF ELECTRIC VEHICLES IN THE UNITED STATES

HS-022 522

POWER TRAIN ENGINEERING FOR PUBLIC SERVICE VEHICLES [BUSES]

HS-022 545

PRACTICAL ASPECTS OF TESTING ANTI-LOCK SYSTEMS ON COMMERCIAL VEHICLES

HS-022 579

STATUTORY TECHNICAL CONTROL OF PUBLIC SERVICE VEHICLES [BUSES] [UNITED KINGDOM]

HS-022 531

TEST AND EVALUATION OF 23 ELECTRIC VEHICLES FOR STATE-OF-THE-ART ASSESSMENT

HS-022 619

THE CHOICE OF MATERIALS IN THE DESIGN AND CONSTRUCTION OF PUBLIC SERVICE VEHICLES [BUSES]

HS-022 541

THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977

HS-022 527

THE OPERATORS' PERFORMANCE REQUIREMENTS FOR POWER UNITS AND TRANSMISSION SYSTEMS FOR PUBLIC SERVICE VEHICLES [BUSES] IN URBAN OPERATION

HS-022 542

## VENTILATING

HEATING AND VENTILATING [OF BUSES] IN U.K. [UNITED KINGDOM]

HS-022 532

## VIBRATION

NEW DESIGNS THROUGH VIBRATION WELDING

HS-022 687

## VICTIMS

CRASH SAFETY FOR RAILROAD PASSENGERS, TRAIN CREWS AND GRADE CROSSING CRASH VICTIMS

HS-022 514

## VIEWS

OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES

HS-022 590

## VISION

A REANALYSIS OF CALIFORNIA DRIVER VISION DATA: GENERAL FINDINGS

HS-022 675

## VISUAL

'AWARE,' AN IN-VEHICLE VISUAL COMMUNICATION SYSTEM FOR DRIVERS

HS-022 685



**VOLKSWAGEN**  
VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE  
BOLSTER RESTRAINT, VWRA--A PRELIMINARY  
FIELD PERFORMANCE EVALUATION--PROGRESS  
REPORT

HS-022 625

**VOLUME**

A METHOD FOR ESTIMATING PEDESTRIAN  
VOLUME IN A CENTRAL BUSINESS DISTRICT

HS-022 631

**VWRA**

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE  
BOLSTER RESTRAINT, VWRA--A PRELIMINARY  
FIELD PERFORMANCE EVALUATION--PROGRESS  
REPORT

HS-022 625

**WARNING**

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY  
SURVEY AND RELAY ALTERNATIVES. FINAL RE-  
PORT

HS-022 691

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE  
AND RELAY DEVICES AND TECHNIQUES. FINAL  
REPORT

HS-022 692

**WARRANTS**

PEDESTRIAN DELAY AND PEDESTRIAN SIGNAL  
WARRANTS

HS-022 628

**WASH**

WINDSHIELD WASH SYSTEMS AND THEIR PUMPS

HS-022 658

**WASHINGTON**

STATEMENT AT THE NATIONAL PRESS CLUB,  
WASHINGTON, D.C., THURSDAY, SEPT. 1, 1977

HS-810 314

**WAY**

CALIFORNIANS LEAD THE WAY IN DEVELOPMENT  
OF ELECTRIC CARS

HS-022 699

**WEATHER**

EVALUATING THE IMPACT OF WEATHER ON BICY-  
CLE USE

HS-022 635

**WEIGHT**

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE  
WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST  
OF ELECTRIC VEHICLES

HS-022 611

**WELDING**

NEW DESIGNS THROUGH VIBRATION WELDING

HS-022 687

**WET**

WET FRICTION--TYRE [TIRE] AND ROAD [BRAKING]

HS-022 575

**WHEEL**

EFFICIENT VEHICLE PACKAGING WITH FRONT-  
WHEEL DRIVE

HS-022 604

THE DYNAMICS OF WHEEL BRAKING

HS-022 572

THE INFLUENCE OF WHEEL SLIP CONTROL  
DYNAMICS ON VEHICLE STABILITY DURING BRAK-  
ING AND STEERING

HS-022 573

**WIDTHS**

ACCIDENT RATES VS SHOULDER WIDTHS. FINAL  
REPORT

HS-022 525

**WIEGAND**

THE WIEGAND EFFECT AND ITS AUTOMOTIVE AP-  
PLICATIONS

HS-022 559

**WINDOWS**

A DESIGN AND EVALUATION STUDY OF HAND-  
HOLDS AND FOOHOLDS FOR EMERGENCY WIN-  
DOWS OF CLASS III PUBLIC SERVICE VEHICLES  
[BUSES]

HS-022 529

**WINDSHIELD**

WINDSHIELD WASH SYSTEMS AND THEIR PUMPS

HS-022 658

**WORD**

PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION  
OF WORD MESSAGE AND OPERATION

HS-022 630

**WORK**

BICYCLE TRANSPORTATION FOR DOWNTOWN  
WORK TRIPS: A CASE STUDY IN DAVIS, CALIFOR-  
NIA

HS-022 633

**WORKSHOPS**

WORKSHOPS ON TRANSPORTATION-AIR QUALITY  
RESEARCH NEEDS FOR STATE, REGIONAL, AND  
LOCAL GOVERNMENT OFFICIALS. FINAL REPORT

HS-022 642

**WORLDWIDE**

A WORLDWIDE OVERVIEW OF AUTOMOTIVE EN-  
GINE CONTROL SENSOR TECHNOLOGY

HS-022 558

**YELLOW**

BEHAVIOUR OF DRIVERS ON YELLOW BAR PAT-  
TERNS - EXPERIMENT ON ALTON BY-PASS,  
HAMPSHIRE

HS-022 679

**YOUNG**

KNOWLEDGE AND PERCEPTIONS OF YOUNG  
PEDESTRIANS

HS-022 629

**ZIRCONIA**

A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR

HS-022 563

## Author Index

- ABAYNAYAKA, S. W.**  
THE EFFECT OF VEHICLE AND ROAD CHARACTERISTICS ON COMMERCIAL VEHICLE SPEEDS IN ETHIOPIA  
HS-022 681
- ABRAMS, C. M.**  
SELECTION OF PEDESTRIAN SIGNAL PHASING  
HS-022 627
- ACKER, JAMES E.**  
TEMPERATURE SENSORS FOR ELECTRONIC ENGINE CONTROL SYSTEMS  
HS-022 562
- ADAMS, W. J. P.**  
PRACTICAL ASPECTS OF TESTING ANTI-LOCK SYSTEMS ON COMMERCIAL VEHICLES  
HS-022 579
- ADDUCI, V. J.**  
THE 1980'S: CHALLENGES OF CHANGE CONFRONTING THE MOTOR VEHICLE AND FREEDOM OF MOBILITY  
HS-022 547
- AFFLECK, W. S.**  
MILEAGE MARATHONS [FUEL ECONOMY]  
HS-022 672
- ALLEN, R. W.**  
TOXIC GASES IN HEAVY DUTY DIESEL TRUCK CABS. FINAL REPORT  
HS-022 696
- ALTENDORF, J. P.**  
ON THE RELATIONSHIP BETWEEN GROSS VEHICLE WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST OF ELECTRIC VEHICLES  
HS-022 611
- ANDERSON, MARY R.**  
DEVELOPMENT OF A BICYCLE ACCIDENT RATE IN ARIZONA  
HS-022 636
- ANDREW, CHARMIAN**  
AN INTERVIEW SURVEY OF MOTORWAY DRIVER INFORMATION REQUIREMENTS AND SIGNAL UNDERSTANDING  
HS-022 673
- ATKINSON, J.**  
THE EFFECT OF VEHICLE MAINTENANCE ON FUEL ECONOMY  
HS-022 667
- AXELROD, M.**  
TOXIC GASES IN HEAVY DUTY DIESEL TRUCK CABS. FINAL REPORT  
HS-022 696
- BAJARIA, H. J.**  
RELIABILITY, MAINTAINABILITY, SAFETY AND HUMAN FACTOR (RMSH) CONSIDERATIONS IN THE AUTOMOTIVE INDUSTRY  
HS-022 519
- BALMER, HARRY E., JR.**  
ANALYSIS OF THE MANDATORY MOTORCYCLE HELMET ISSUE  
HS-022 694
- BARDSLEY, MARGUERITE N.**  
ROAD ACCIDENTS AS A CAUSE OF DEATH IN DEVELOPING COUNTRIES  
HS-022 683
- BAXTER, W. L.**  
REVIEW OF BRAKING LEGISLATION IN BRITAIN DURING THE PAST DECADE  
HS-022 597
- BAYLER, TED**  
IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMOTIVE FUEL ECONOMY AND EMISSIONS  
HS-022 515
- BEALE, E. H., COMP.**  
COMPILATION OF REPORTS GENERATED BY THE TIRE SYSTEMS DIVISION, SAFETY RESEARCH LABORATORY, 1967 THRU JANUARY 1978. PRELIMINARY REPORT  
HS-803 312
- BEATTIE, IAN**  
THE COMPLETE BOOK OF AUTOMOBILE BODY DESIGN  
HS-022 695
- BEHNAM, JAHANBAKSH**  
A METHOD FOR ESTIMATING PEDESTRIAN VOLUME IN A CENTRAL BUSINESS DISTRICT  
HS-022 631
- BELL, A. G.**  
MOTOR GASOLINE AND THE EFFECT OF COMPRESSION RATIO ON OCTANE REQUIREMENT AND FUEL ECONOMY  
HS-022 663
- BELL, ROBERT L.**  
THE FIRST PRODUCTION AUTOMOTIVE CAPACITIVE PRESSURE SENSOR  
HS-022 565
- BELLOMO, SALVATORE J.**  
EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING ISSUES, TECHNIQUES, AND THEIR RELATIONSHIPS  
HS-022 550
- BENDER, MAX**  
HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM  
HS-022 701
- BENNETT, MARIE**  
SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT STUDY AMONGST CHILDREN  
HS-022 684
- BINTZ, LOUIS J.**  
THE TARGET CAR PROGRAM FOR 1977  
HS-022 603

- BISHOP, E. W.**  
EVALUATION OF SCREENING BREATH TESTING IN  
TRAFFIC LAW ENFORCEMENT. FINAL REPORT  
HS-803 274
- BLACKMORE, D. R. , ED.**  
FUEL ECONOMY OF THE GASOLINE ENGINE.  
FUEL, LUBRICANT AND OTHER EFFECTS  
HS-022 661
- BLACKMORE, D. R.**  
PRINCIPLES GOVERNING FUEL ECONOMY IN A  
GASOLINE ENGINE  
HS-022 662
- THE EFFECT OF EMISSION CONTROLS ON FUEL  
ECONOMY  
HS-022 668
- BOND, R.**  
THE TYRE/ROAD [TIRE/ROAD] INTERFACE--ITS EF-  
FECT ON BRAKING  
HS-022 574
- BOORD, J. O.**  
HOW PASSENGER CAR MAINTENANCE AFFECTS  
FUEL ECONOMY AND EMISSIONS. A NATIONWIDE  
SURVEY  
HS-022 517
- BOYD, P. L.**  
THE USE OF THE MOBILE TIRE TRACTION  
DYNAMOMETER IN RESEARCH  
HS-022 609
- BRADEN, PATRICIA L.**  
CONSUMER ACCEPTANCE OF DOWN-SIZED AU-  
TOMOBILES  
HS-022 523
- BRODD, S.**  
THE INFLUENCE OF WHEEL SLIP CONTROL  
DYNAMICS ON VEHICLE STABILITY DURING BRAK-  
ING AND STEERING  
HS-022 573
- BROWN, P. W.**  
PARAMETERS FOR THE USE OF DISC BRAKES IN-  
CORPORATING AUTOMATICALLY ADJUSTED HAND-  
BRAKE MECHANISMS  
HS-022 620
- BULL, B.**  
THE EFFECT OF CRANKCASE LUBRICANTS ON  
FUEL ECONOMY  
HS-022 670
- BURCKHARDT, M.**  
EVALUATION OF THE BRAKING PERFORMANCE OF  
PASSENGER CARS WITH FIXED AND WITH  
'KINKED' BRAKE-FORCE DISTRIBUTIONS  
HS-022 577
- BURG, A.**  
A REANALYSIS OF CALIFORNIA DRIVER VISION  
DATA: GENERAL FINDINGS  
HS-022 675
- BURNEY, GEORGINA M.**  
BEHAVIOUR OF DRIVERS ON YELLOW BAR PAT-  
TERNS - EXPERIMENT ON ALTON BY-PASS,  
HAMPSHIRE  
HS-022 679
- BURRIDGE, G.**  
SOME SIGNIFICANT DEVELOPMENTS IN AIR  
BRAKE SYSTEM COMPONENTS  
HS-022 580
- BURT, R.**  
THE MEASUREMENT OF FUEL ECONOMY  
HS-022 669
- CADDOCK, B. D.**  
THE EFFECT OF THE PHYSICAL PROPERTIES OF  
GASOLINE ON FUEL ECONOMY  
HS-022 664
- CANTILLI, EDMUND J.**  
SYSTEM-SAFETY TECHNIQUES USEFUL FOR  
TRANSPORTATION SAFETY  
HS-022 641
- CARAPELLOTTI, LAWRENCE R.**  
THE ADHESIVE TESTING OF HIGH STRENGTH  
LAMINATES FOR STRUCTURAL DURABILITY  
HS-022 678
- CARLIN, T.**  
TOXIC GASES IN HEAVY DUTY DIESEL TRUCK  
CABS. FINAL REPORT  
HS-022 696
- CHAPMAN, B. J.**  
CAST IRON BRAKE ROTOR METALLURGY  
HS-022 581
- CHIANG, S. L.**  
USING COMPUTER SIMULATION TO EVALUATE  
AND IMPROVE VEHICLE HANDLING  
HS-022 513
- CLAYBROOK, JOAN**  
STATEMENT AT THE NATIONAL PRESS CLUB,  
WASHINGTON, D.C., THURSDAY, SEPT. 1, 1977  
HS-810 314
- COHEN, HARRY S.**  
EVALUATING OPTIONS IN STATEWIDE TRANSPOR-  
TATION PLANNING/PROGRAMMING ISSUES,  
TECHNIQUES, AND THEIR RELATIONSHIPS  
HS-022 550
- COLE, B. L.**  
STUDY OF MOTOR VEHICLE SIGNAL SYSTEMS.  
FINAL REPORT  
HS-022 690
- COLIN, J. F.**  
THE EFFECT OF SURGICAL OPERATION ON THE  
'BRAKE-CLUTCH SIMULATOR'  
HS-022 589
- COOK, J. C. , 2ND**  
APPLICATION OF A CRANKSHAFT POSITION SEN-  
SOR TO CONTROL ENGINE TIMING  
HS-022 564

August 31, 1978

**COOK, WENDELL A.**

REPAIR INDUSTRY RESPONSE TO DIAGNOSTIC INSPECTION PROJECTS

HS-022 516

**COX, B. J.**

ENVIRONMENTAL REQUIREMENTS FOR PSV [PUBLIC SERVICE VEHICLE] OPERATION [BUSES]

HS-022 530

**CURTIS, C. H.**

HYDRAULIC SUSPENSIONS WITH PARTICULAR REFERENCE TO PUBLIC SERVICE VEHICLES [BUSES]

HS-022 534

**DAIN, S. J.**

STUDY OF MOTOR VEHICLE SIGNAL SYSTEMS. FINAL REPORT

HS-022 690

**DANIEL, ANDRE**

EFFICIENT VEHICLE PACKAGING WITH FRONT-WHEEL DRIVE

HS-022 604

**DE BRIEL, J. THIRION**

RECENT PROGRESS IN BRAKING TESTS BY USE OF A CAR DYNAMOMETER

HS-022 583

**DENINGTON, ROBERT J.**

TEST AND EVALUATION OF 23 ELECTRIC VEHICLES FOR STATE-OF-THE-ART ASSESSMENT

HS-022 619

**DENNISS, ROGER**

BRAKE PERFORMANCE AND COSTS--COMMERCIAL VEHICLES

HS-022 601

**DINAPOLI, N.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2: COMPREHENSIVE TECHNICAL RESULTS. FINAL REPORT

HS-803 250

**DORSEY, WARREN F.**

A STATUS REPORT ON VEHICLE DETECTORS. FINAL REPORT

HS-022 698

**DOWNING, C. S.**

SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT STUDY AMONGST CHILDREN

HS-022 684

**DULL, ERNST HERMANN**

COLLISION AVOIDANCE SYSTEM FOR AUTOMOBILES

HS-022 614

**DUSTIN, MILES O.**

TEST AND EVALUATION OF 23 ELECTRIC VEHICLES FOR STATE-OF-THE-ART ASSESSMENT

HS-022 619

**DUVIVIER, C. L.**

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL

EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES. FINAL REPORT

HS-022 691

**EDER, LESLIE**

IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMOTIVE FUEL ECONOMY AND EMISSIONS

HS-022 515

**EDWARDS, MARY**

A DESIGN AND EVALUATION STUDY OF HANDHOLDS AND FOOTHOLDS FOR EMERGENCY WINDOWS OF CLASS III PUBLIC SERVICE VEHICLES [BUSES]

HS-022 529

**EHRICKE, OTTO**

AIR BRAKING SYSTEMS FOR COMMERCIAL VEHICLES IN COMPLIANCE WITH THE EEC-DIRECTIVE 71/320 BRAKING

HS-022 602

AIR BRAKING SYSTEMS WITH INCREASED PRESSURE

HS-022 598

**ELGESKOG, E.**

THE INFLUENCE OF WHEEL SLIP CONTROL DYNAMICS ON VEHICLE STABILITY DURING BRAKING AND STEERING

HS-022 573

**ELLINGSTAD, V. S.**

INTERIM ANALYSIS OF STR [SHORT TERM REHABILITATION] PERFORMANCE AND EFFECTIVENESS. TWELVE-MONTH ANALYSES

HS-803 285

**EMMELMANN, H.-J.**

AERODYNAMIC IMPROVEMENTS--A GREAT POTENTIAL FOR BETTER FUEL ECONOMY

HS-022 615

**ERVIN, R. D.**

MEASUREMENTS OF THE LONGITUDINAL AND LATERAL TRACTION PROPERTIES OF TRUCK TIRES

HS-022 576

**ESPOSITO, VINCENT J.**

OVERVIEW OF ELECTRIC VEHICLES IN THE UNITED STATES

HS-022 522

**FANCHER, P. S.**

COMPUTER ANALYSIS OF ANTILOCK SYSTEM PERFORMANCE IN THE BRAKING OF COMMERCIAL VEHICLES

HS-022 578

**FETTERMAN, G. P., JR.**

ECONOMIC COMPARISON OF FUTURE AUTOMOTIVE POWER SYSTEMS

HS-022 518

**FISHER, A. J.**

STUDY OF MOTOR VEHICLE SIGNAL SYSTEMS. FINAL REPORT

HS-022 690

- THACKER, M.  
RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2:  
COMPREHENSIVE TECHNICAL RESULTS. FINAL RE-  
PORT  
HS-803 250
- FOSTER, H. J.  
POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY  
SURVEY AND RELAY ALTERNATIVES. FINAL RE-  
PORT  
HS-022 691
- FREELove, R. E.  
THE OPERATORS' PERFORMANCE REQUIREMENTS  
FOR POWER UNITS AND TRANSMISSION SYSTEMS  
FOR PUBLIC SERVICE VEHICLES [BUSES] IN  
URBAN OPERATION  
HS-022 542
- FRIEDMAN, D.  
RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 1: EX-  
ECUTIVE SUMMARY. FINAL REPORT  
HS-803 249
- FUNAHASHI, AKIO  
ENERGY ABSORPTION BY THE PLASTIC DEFORMA-  
TION OF BODY STRUCTURAL MEMBERS  
HS-022 622
- FUNKE, JIMMY L.  
TARGET IDENTIFICATION CAPABILITY OF SWEEP  
FREQUENCY AUTOMOBILE RADAR  
HS-022 613
- FURUICHI, TAKAHISA  
DYNAMIC CORNERING PROPERTIES OF TIRES  
HS-022 607
- GARRETT, KEN  
WINDSHIELD WASH SYSTEMS AND THEIR PUMPS  
HS-022 658
- GATLING, FRANK P.  
HIGHWAY ADVISORY RADIO IN CONSTRUCTION  
AREAS. FINAL REPORT  
HS-022 697
- GILLIS, J.  
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANS-  
PORTATION --A FEASIBILITY STUDY. VOL. 2--  
TECHNICAL SECTION  
HS-022 644
- ALTERNATIVE FUELS FOR AUTOMOTIVE TRANS-  
PORTATION--A FEASIBILITY STUDY. VOL. 1--EX-  
ECUTIVE SUMMARY  
HS-022 643
- GLASSBOROW, D. W.  
PROSPECTS FOR BUS AND COACH TRANSPORT  
[UNITED KINGDOM]  
HS-022 528
- GODFREY, L. W. D.  
RELIABILITY AND MAINTAINABILITY OF BRAKING  
SYSTEMS--MILITARY APPLICATIONS  
HS-022 594
- GORANSSON, C. A.  
EVALUATION OF SCREENING BREATH TESTING IN  
TRAFFIC LAW ENFORCEMENT. FINAL REPORT  
HS-803 274
- HALES, F. D.  
LATERAL STABILITY OF COMMERCIAL ROAD VEHI-  
CLE TRAINS UNDER BRAKING CONDITIONS  
HS-022 570
- HAMILTON, WILLIAM  
BASIC REQUIREMENTS FOR URBAN CARS  
HS-022 610
- HANNAM, M. J.  
THE CHOICE OF MATERIALS IN THE DESIGN AND  
CONSTRUCTION OF PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 541
- HANSON, EDWARD K.  
AN OVERALL DESIGN APPROACH TO IMPROVING  
PASSENGER CAR FUEL ECONOMY  
HS-022 605
- HANSON, PERRY  
EVALUATING THE IMPACT OF WEATHER ON BICY-  
CLE USE  
HS-022 635
- HANSON, SUSAN  
EVALUATING THE IMPACT OF WEATHER ON BICY-  
CLE USE  
HS-022 635
- HARROW, G. A.  
THE EFFECT OF MIXTURE PREPARATION ON FUEL  
ECONOMY  
HS-022 666
- HARTLEY, JOHN  
ENGINE DESIGN SERIES: FUEL SYSTEMS--DIESEL  
HS-022 659
- HATCH, D.  
CAST IRON BRAKE ROTOR METALLURGY  
HS-022 581
- HATTERICK, G. RICHARD  
SKILL TRAINING FOR COLLISION AVOIDANCE  
HS-022 640
- HIDE, H.  
THE EFFECT OF VEHICLE AND ROAD CHARAC-  
TERISTICS ON COMMERCIAL VEHICLE SPEEDS IN  
ETHIOPIA  
HS-022 681
- HILLEL, H.  
HYDRAULIC SUSPENSIONS WITH PARTICULAR  
REFERENCE TO PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 534
- HILLS, B. L.  
A REANALYSIS OF CALIFORNIA DRIVER VISION  
DATA: GENERAL FINDINGS  
HS-022 675

August 31, 1978

**HINCH, JOHN**

THE USE OF THE MOBILE TIRE TRACTION  
DYNAMOMETER IN RESEARCH

HS-022 609

**HOBBS, C. A.**

BRAKE DEFECTS IN CARS

HS-022 591

**HODGE, A. R.**

'AWARE,' AN IN-VEHICLE VISUAL COMMUNICA-  
TION SYSTEM FOR DRIVERS

HS-022 685

**HOGG, RACHEL**

A STUDY OF MALE MOTORISTS' ATTITUDES TO  
SPEED RESTRICTIONS AND THEIR ENFORCEMENT

HS-022 682

**HOLMSTROM, F. ROSS**

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE  
AND RELAY DEVICES AND TECHNIQUES. FINAL  
REPORT

HS-022 692

**HORODNICEANU, MICHAEL**

SYSTEM-SAFETY TECHNIQUES USEFUL FOR  
TRANSPORTATION SAFETY

HS-022 641

**HORTON, JERRY**

AUTOMOTIVE FLEET FUEL CONSUMPTION MODEL:  
FUEL. FOR. FINAL REPORT

HS-803 223

**HOWARTH, DAVID S.**

A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR

HS-022 563

**HUMPHRYS, A. J.**

THE EFFECT OF CRANKCASE LUBRICANTS ON  
FUEL ECONOMY

HS-022 670

**INGRAM, B.**

BRAKING SYSTEMS FOR RIGID VEHICLES

HS-022 568

**JACOBS, G. D.**

A STUDY OF ROAD ACCIDENTS IN SELECTED  
URBAN AREAS IN DEVELOPING COUNTRIES

HS-022 676

ROAD ACCIDENTS AS A CAUSE OF DEATH IN  
DEVELOPING COUNTRIES

HS-022 683

**JACOBS, KENNETH M.**

ENERGY USE AND OTHER COMPARISONS  
BETWEEN DIESEL AND GASOLINE PICKUP  
TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977

HS-022 548

**JACOBSON, M. A.**

ANTI-CORROSIVE PROTECTION OF CARS

HS-022 660

**JANSSEN, L. J.**

AERODYNAMIC IMPROVEMENTS--A GREAT POTEN-  
TIAL FOR BETTER FUEL ECONOMY

HS-022 615

**JOHNSON, M. A.**

THE NATIONAL PSV [PUBLIC SERVICE VEHICLE]  
ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED  
STUDY [BUSES]

HS-022 544

**JONES, D. V.**

STATUTORY TECHNICAL CONTROL OF PUBLIC  
SERVICE VEHICLES [BUSES] [UNITED KINGDOM]

HS-022 531

**JONES, MARGARET HUBBARD**

MEASURING THE OUTCOMES OF DRIVER TRAIN-  
ING: UNIVERSITY OF SOUTHERN CALIFORNIA  
DRIVER PERFORMANCE TEST

HS-022 639

**KALBERLAH, A.**

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE  
WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST  
OF ELECTRIC VEHICLES

HS-022 611

**KANAYA, OSAMU**

THE EFFECT OF HYDROPLANING ON THE DYNAM-  
IC CHARACTERISTICS OF CAR, TRUCK AND BUS  
TIRES

HS-022 608

**KECMAN, D.**

INVESTIGATION OF PSV [PUBLIC SERVICE VEHI-  
CLE] ROLL OVER SAFETY [BUSES]

HS-022 535

**KING, G. F.**

PEDESTRIAN DELAY AND PEDESTRIAN SIGNAL  
WARRANTS

HS-022 628

**KLAHS, JOSEPH W.**

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY  
UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS  
TECHNIQUES

HS-022 621

**KNOBLAUCH, RICHARD L.**

ACCIDENT DATA BASE FOR URBAN PEDESTRIANS

HS-022 632

**KRAMER, MAURY**

THE TARGET CAR PROGRAM FOR 1977

HS-022 603

**LAYTON, ROBERT D.**

EFFECT OF BICYCLE LANE USAGE ON VEHICLES  
IN THE ADJACENT LANE

HS-022 637

**LEA, K. E.**

POWER TRAIN ENGINEERING FOR PUBLIC SERVICE  
VEHICLES [BUSES]

HS-022 545

- LINES, C. J.**  
'AWARE,' AN IN-VEHICLE VISUAL COMMUNICATION SYSTEM FOR DRIVERS  
HS-022 685
- LIPPMAN, S. A.**  
SOURCES OF ROLLING RESISTANCE IN RADIAL PLY TIRES  
HS-022 612
- LIVINGSTONE, P. D.**  
LEGISLATIVE CONTROL OF ARTICULATED VEHICLE BRAKING [EUROPE]  
HS-022 595
- LOOP, STEPHEN B.**  
EFFECT OF BICYCLE LANE USAGE ON VEHICLES IN THE ADJACENT LANE  
HS-022 637
- LOTT, DALE F.**  
BICYCLE TRANSPORTATION FOR DOWNTOWN WORK TRIPS: A CASE STUDY IN DAVIS, CALIFORNIA  
HS-022 633
- LOTT, DONNA Y.**  
BICYCLE TRANSPORTATION FOR DOWNTOWN WORK TRIPS: A CASE STUDY IN DAVIS, CALIFORNIA  
HS-022 633
- LUCHTER, STEPHEN**  
AN ASSESSMENT OF THE TECHNOLOGY OF RANKINE ENGINES FOR AUTOMOBILES  
HS-022 647
- LUM, WESLEY**  
CITIZEN PARTICIPATION IN PLANNING AND DESIGNING BIKEWAYS  
HS-022 634
- MACADAM, C. C.**  
COMPUTER ANALYSIS OF ANTILOCK SYSTEM PERFORMANCE IN THE BRAKING OF COMMERCIAL VEHICLES  
HS-022 578
- MAGEE, C. L.**  
DESIGN CONSIDERATIONS IN ENERGY ABSORPTION BY STRUCTURAL COLLAPSE  
HS-022 624
- MARKS, J. DAVID**  
THE WIEGAND EFFECT AND ITS AUTOMOTIVE APPLICATIONS  
HS-022 559
- MARX, GARY M.**  
THE FIRST PRODUCTION AUTOMOTIVE CAPACITIVE PRESSURE SENSOR  
HS-022 565
- MASSING, DANIEL E.**  
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OCTOBER TO 31 OCTOBER 1977  
HS-803 313
- EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 9, 1 NOVEMBER TO 30 NOVEMBER 1977**  
HS-803 318
- EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 10, 1 DECEMBER TO 31 DECEMBER 1977**  
HS-803 319
- EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978**  
HS-803 320
- EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978**  
HS-803 321
- MATOLCSY, M.**  
BUS RESEARCH AND DEVELOPMENT AT AUTOKUT RESEARCH INSTITUTE, HUNGARY  
HS-022 540
- MATTHIAS, JUDSON S.**  
DEVELOPMENT OF A BICYCLE ACCIDENT RATE IN ARIZONA  
HS-022 636
- MAURI, G.**  
ECONOMIC COMPARISON OF FUTURE AUTOMOTIVE POWER SYSTEMS  
HS-022 518
- MCDONALD, JOHN W.**  
THE TARGET CAR PROGRAM FOR 1977  
HS-022 603
- MEHRA, JAWAHARLAL J.**  
EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING ISSUES, TECHNIQUES, AND THEIR RELATIONSHIPS  
HS-022 550
- MELVIN, JOHN W.**  
HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR BIOSCIENCES RESEARCH: FINAL TECHNICAL LETTER REPORT ON NSF [NATIONAL SCIENCE FOUNDATION] PROGRAM  
HS-022 701
- MENGASON, JIM**  
NEW DESIGNS THROUGH VIBRATION WELDING  
HS-022 687
- METTERS, J. J.**  
SOURCES OF ROLLING RESISTANCE IN RADIAL PLY TIRES  
HS-022 612
- MICKE, S.**  
PARAMETERS FOR THE USE OF DISC BRAKES INCORPORATING AUTOMATICALLY ADJUSTED HANDBRAKE MECHANISMS  
HS-022 620

August 31, 1978

- MILES, J. C.**  
INVESTIGATION OF PSV [PUBLIC SERVICE VEHICLE] ROLL OVER SAFETY [BUSES]  
HS-022 535
- MILLER, S. R.**  
VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT  
HS-022 625
- MILLNER, N.**  
A THEORY OF DRUM BRAKE SQUEAL  
HS-022 585
- MOLINIER, P.**  
RECENT PROGRESS IN BRAKING TESTS BY USE OF A CAR DYNAMOMETER  
HS-022 583
- MOLNAR, C.**  
PLASTIC DEFORMATIONS AND ENERGY CONSUMPTION AT DYNAMIC (IMPACT) LOADS  
HS-022 543
- MOROSIUK, G.**  
THE EFFECT OF VEHICLE AND ROAD CHARACTERISTICS ON COMMERCIAL VEHICLE SPEEDS IN ETHIOPIA  
HS-022 681
- MORTIMER, R. G.**  
EVALUATION OF MEETING BEAMS OF TWO- AND THREE-BEAM HEADLIGHTING SYSTEMS  
HS-022 700  
IMPLICATIONS OF SOME CHARACTERISTICS OF DRIVERS FOR BRAKE SYSTEM PERFORMANCE  
HS-022 586
- NEILL, A. H. , JR.**  
THE USE OF THE MOBILE TIRE TRACTION DYNAMOMETER IN RESEARCH  
HS-022 609
- NEILSON, I. D.**  
ACCIDENTS INVOLVING LOSS OF CONTROL WHEN BRAKING - A STUDY OF THE ON-THE-SPOT SURVEY DATA  
HS-022 588
- NEWCOMB, T. P.**  
BASIC PRINCIPLES [VEHICLE BRAKING]  
HS-022 567
- NEWTON, W. R.**  
BRAKES--A REVIEW OF EXISTING DESIGN  
HS-022 582
- NICHOLSON, D.**  
ALLISON AUTOMATIC TRANSMISSIONS FOR PUBLIC SERVICE VEHICLES [BUSES]  
HS-022 538
- NOGUCHI, THOMAS T.**  
NECK INJURY ASSESSMENT PROTOCOL. FINAL REPORT  
HS-803 287
- NORTH, M. R.**  
DISC BRAKE SQUEAL  
HS-022 584
- OATES, J. F. , JR.**  
EVALUATION OF SCREENING BREATH TESTING IN TRAFFIC LAW ENFORCEMENT. FINAL REPORT  
HS-803 274
- OBLIZAJEK, K. L.**  
SOURCES OF ROLLING RESISTANCE IN RADIAL PLY TIRES  
HS-022 612
- ODIER, J. A.**  
RECENT PROGRESS IN BRAKING TESTS BY USE OF A CAR DYNAMOMETER  
HS-022 583
- OKAYAMA, TAKUMI**  
THE EFFECT OF HYDROPLANING ON THE DYNAMIC CHARACTERISTICS OF CAR, TRUCK AND BUS TIRES  
HS-022 608
- OLSON, P. L.**  
EVALUATION OF MEETING BEAMS OF TWO- AND THREE-BEAM HEADLIGHTING SYSTEMS  
HS-022 700
- OLSON, PAUL L.**  
THE RELATIVE MERITS OF DIFFERENT LOW BEAM HEADLIGHTING SYSTEMS - A REVIEW OF THE LITERATURE. FINAL REPORT  
HS-022 704
- OPPENHEIMER, PAUL**  
BRAKING REGULATIONS IN EUROPE  
HS-022 596
- PACKER, M. B.**  
THE DYNAMICS OF WHEEL BRAKING  
HS-022 572
- PADMORE, E. L.**  
THE EFFECT OF TRANSMISSION LUBRICANTS ON FUEL ECONOMY  
HS-022 671
- PAIN, RICHARD F.**  
SKILL TRAINING FOR COLLISION AVOIDANCE  
HS-022 640
- PANGBORN, J.**  
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION--A FEASIBILITY STUDY. VOL. 1--EXECUTIVE SUMMARY  
HS-022 643  
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION --A FEASIBILITY STUDY. VOL. 2--TECHNICAL SECTION  
HS-022 644
- PARSONS, J. D. W.**  
RELIABILITY AND MAINTAINABILITY OF BRAKING SYSTEMS--MILITARY APPLICATIONS  
HS-022 594



- PEASLEY, D.**  
BRAKING SYSTEMS FOR RIGID VEHICLES  
HS-022 568
- PEEL, R. J.**  
DESIGN, CONSTRUCTION AND APPLICATION OF  
AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE]  
SUSPENSION [BUSES]  
HS-022 533
- PENNELLS, J. H.**  
THE TYRE/ROAD [TIRE/ROAD] INTERFACE-ITS EF-  
FECT ON BRAKING  
HS-022 574
- PERREAULT, RICHARD G.**  
DEVELOPMENT OF A BICYCLE ACCIDENT RATE IN  
ARIZONA  
HS-022 636
- PETERS, HANS JOACHIM**  
COLLISION AVOIDANCE SYSTEM FOR AUTOMO-  
BILES  
HS-022 614
- PETERSILIA, MICHAEL R.**  
EVALUATING OPTIONS IN STATEWIDE TRANSPOR-  
TATION PLANNING/PROGRAMMING ISSUES,  
TECHNIQUES, AND THEIR RELATIONSHIPS  
HS-022 550
- PETTY, S. P. F.**  
PROTECTION FOR PUBLIC SERVICE VEHICLE [BUS]  
OCCUPANTS IN FRONTAL IMPACTS  
HS-022 546
- PHILLIPS, PETER**  
EFFICIENT VEHICLE PACKAGING WITH FRONT-  
WHEEL DRIVE  
HS-022 604
- PIGNATARO, LOUIS J.**  
SYSTEM-SAFETY TECHNIQUES USEFUL FOR  
TRANSPORTATION SAFETY  
HS-022 641
- PIGOTT, J. S.**  
HOW PASSENGER CAR MAINTENANCE AFFECTS  
FUEL ECONOMY AND EMISSIONS. A NATIONWIDE  
SURVEY  
HS-022 517
- PITCHER, R. H.**  
HYDRAULIC SUSPENSIONS WITH PARTICULAR  
REFERENCE TO PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 534
- POSTLE, O.**  
THE EFFECT OF VEHICLE MAINTENANCE ON FUEL  
ECONOMY  
HS-022 667
- RATH, H.**  
PARAMETERS FOR THE USE OF DISC BRAKES IN-  
CORPORATING AUTOMATICALLY ADJUSTED HAND-  
BRAKE MECHANISMS  
HS-022 620
- REBIFFE, ROGER**  
EFFICIENT VEHICLE PACKAGING WITH FRONT-  
WHEEL DRIVE  
HS-022 604
- REDDY, J. N.**  
APPLICATION OF AUTOMOTIVE SENSORS TO EN-  
GINE CONTROL  
HS-022 561
- REHMAN, IRVING**  
NECK INJURY ASSESSMENT PROTOCOL. FINAL RE-  
PORT  
HS-803 287
- REID, J. A.**  
RECOGNITION DISTANCES OF VEHICLE REAR  
MARKINGS AT NIGHT  
HS-022 689
- REISS, MARTIN L.**  
KNOWLEDGE AND PERCEPTIONS OF YOUNG  
PEDESTRIANS  
HS-022 629
- RENNER, ROY A.**  
AN ASSESSMENT OF THE TECHNOLOGY OF RAN-  
KINE ENGINES FOR AUTOMOBILES  
HS-022 647
- RENO, ARLEE T.**  
EVALUATING OPTIONS IN STATEWIDE TRANSPOR-  
TATION PLANNING/PROGRAMMING ISSUES,  
TECHNIQUES, AND THEIR RELATIONSHIPS  
HS-022 550
- RICCI, R. L.**  
ECONOMIC COMPARISON OF FUTURE AUTOMO-  
TIVE POWER SYSTEMS  
HS-022 518
- RINDE, E. A.**  
ACCIDENT RATES VS SHOULDER WIDTHS. FINAL  
REPORT  
HS-022 525
- ROBERTSON, H. DOUGLAS**  
PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION  
OF WORD MESSAGE AND OPERATION  
HS-022 630
- ROBINSON, I. C. H.**  
THE EFFECT OF GASOLINE ADDITIVES ON FUEL  
ECONOMY  
HS-022 665
- ROGERS, L. M.**  
POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL

HS-022 691

**SHEPPARD, D.**

A CONTENT ANALYSIS OF FIVE BOOKS ON DRIVING

HS-022 688

**SHILTON, B. R.**

NON-RIGID VEHICLE BRAKING SYSTEMS

HS-022 569

**SHOUMAN, MARTIN L.**

SYSTEM-SAFETY TECHNIQUES USEFUL FOR TRANSPORTATION SAFETY

HS-022 641

**SINKO, MICHAEL J.**

THE WIEGAND EFFECT AND ITS AUTOMOTIVE APPLICATIONS

HS-022 559

**SLACK, I. R.**

A REVIEW OF COMMERCIAL VEHICLE BRAKES

HS-022 599

BRAKING BUSES

HS-022 537

**SMETHURST, R.**

THE CHOICE OF MATERIALS IN THE DESIGN AND CONSTRUCTION OF PUBLIC SERVICE VEHICLES [BUSES]

HS-022 541

**SMITH, P. H. WYKE**

OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES

HS-022 590

**SMITH, S. A.**

SELECTION OF PEDESTRIAN SIGNAL PHASING

HS-022 627

**SPENCE, D. R.**

PRACTICAL ASPECTS OF TESTING ANTI-LOCK SYSTEMS ON COMMERCIAL VEHICLES

HS-022 579

**STARR, D. S.**

USING COMPUTER SIMULATION TO EVALUATE AND IMPROVE VEHICLE HANDLING

HS-022 513

**STATES, J. D.**

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT

HS-022 625

**STORIE, VALERIE J.**

MALE AND FEMALE CAR DRIVERS: DIFFERENCES OBSERVED IN ACCIDENTS

HS-022 674

**ROPER, WILLIAM L.**

CALIFORNIANS LEAD THE WAY IN DEVELOPMENT OF ELECTRIC CARS

HS-022 699

**SADEGHI, M. M.**

INVESTIGATION OF PSV [PUBLIC SERVICE VEHICLE] ROLL OVER SAFETY [BUSES]

HS-022 535

**SAKAI, HIDEO**

A DATA RECORDING SYSTEM OF THE PATH OF A TEST VEHICLE BY LASER BEAM AND SOME APPLICATIONS TO STEERING HANDLING TEST

HS-022 520

DYNAMIC CORNERING PROPERTIES OF TIRES

HS-022 607

THE EFFECT OF HYDROPLANING ON THE DYNAMIC CHARACTERISTICS OF CAR, TRUCK AND BUS TIRES

HS-022 608

**SARIDAKIS, N.**

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST OF ELECTRIC VEHICLES

HS-022 611

**SAYER, I. A.**

A STUDY OF ROAD ACCIDENTS IN SELECTED URBAN AREAS IN DEVELOPING COUNTRIES

HS-022 676

**SCHIMKAT, H.**

PASSIVE VEHICLE SAFETY AS CARS GROW SMALLER

HS-022 617

**SCHMIDT, HERBERT**

DISC BRAKES FOR COMMERCIAL VEHICLES

HS-022 600

**SCHWARTZ, S. H.**

TOXIC GASES IN HEAVY DUTY DIESEL TRUCK CABS. FINAL REPORT

HS-022 696

**SEIFFERT, U. W.**

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE BOLSTER RESTRAINT, VWRA--A PRELIMINARY FIELD PERFORMANCE EVALUATION--PROGRESS REPORT

HS-022 625

**SHARP, R. S.**

THE STABILITY OF MOTORCYCLES IN ACCELERATION AND DECELERATION

HS-022 571

**SHEFFIELD, W.**

POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY

**STOUDT, HOWARD W.**

ARE PEOPLE STILL GETTING BIGGER--WHO, WHERE, AND HOW MUCH? [DESIGN OF AUTOMOTIVE EQUIPMENT]

HS-022 616

**STOWERS, JOSEPH R.**

EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING ISSUES, TECHNIQUES, AND THEIR RELATIONSHIPS

HS-022 550

**STRASSHEIMER, H.**

DESIGN INNOVATIONS FACILITATING ECONOMIC PRODUCTION OF GIANT MOULDINGS

HS-022 552

**STRAWN, V. L.**

INTERIM ANALYSIS OF STR [SHORT TERM REHABILITATION] PERFORMANCE AND EFFECTIVENESS. TWELVE-MONTH ANALYSES

HS-803 285

**STRIFLER, P.**

ANALYTICAL COMPARISON OF INTEGRAL AND CHASSIS DESIGN ON BUSES

HS-022 539

**STROTHER, C.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2: COMPREHENSIVE TECHNICAL RESULTS. FINAL REPORT

HS-803 250

**STRUBLE, D.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 1: EXECUTIVE SUMMARY. FINAL REPORT

HS-803 249

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2: COMPREHENSIVE TECHNICAL RESULTS. FINAL REPORT

HS-803 250

**STRUCKMAN-JOHNSON, D. L.**

INTERIM ANALYSIS OF STR [SHORT TERM REHABILITATION] PERFORMANCE AND EFFECTIVENESS. TWELVE-MONTH ANALYSES

HS-803 285

**SUTTON, E. R.**

HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY

HS-022 517

**TANI, MASANORI**

ENERGY ABSORPTION BY THE PLASTIC DEFORMATION OF BODY STRUCTURAL MEMBERS

HS-022 622

**TANNER, R.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2: COMPREHENSIVE TECHNICAL RESULTS. FINAL REPORT

HS-803 250

**TARDIFF, TIMOTHY J.**

BICYCLE TRANSPORTATION FOR DOWNTOWN WORK TRIPS: A CASE STUDY IN DAVIS, CALIFORNIA

HS-022 633

**THOMAS, A., ED.**

FUEL ECONOMY OF THE GASOLINE ENGINE. FUEL, LUBRICANT AND OTHER EFFECTS

HS-022 661

**THOMPSON, STEVE**

HIGH DRIVING [DRUNK DRIVING]

HS-022 549

**THORNTON, P. H.**

DESIGN CONSIDERATIONS IN ENERGY ABSORPTION BY STRUCTURAL COLLAPSE

HS-022 624

**TIDBURY, G. H.**

INVESTIGATION OF PSV [PUBLIC SERVICE VEHICLE] ROLL OVER SAFETY [BUSES]

HS-022 535

**TODOROVIC, JOVAN**

THEORY OF RELIABILITY AND ITS APPLICATION TO VEHICLE BRAKES AND BRAKING SYSTEMS

HS-022 593

**TOFT, G. B.**

MILEAGE MARATHONS [FUEL ECONOMY]

HS-022 672

**TOWNLEY, GARY E.**

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS TECHNIQUES

HS-022 621

**VARLEY, R. J.**

POWER TRAIN-ENGINEERING FOR PUBLIC SERVICE VEHICLES [BUSES]

HS-022 545

**VON OSTENWALL, E. C. GLASNER**

EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS

HS-022 577

**WAKELAND, HENRY H.**

CRASH SAFETY FOR RAILROAD PASSENGERS, TRAIN CREWS AND GRADE CROSSING CRASH VICTIMS

HS-022 514

**WALKER, D. L.**

HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY

HS-022 517

**WALL, A. J.**

HEATING AND VENTILATING [OF BUSES] IN U.K. [UNITED KINGDOM]

HS-022 532

**WASHBURN, CLINTON T.**

CYBERMAN--A HUMAN FACTORS ANALYSIS OF SCHOOL BUS DRIVER PERFORMANCE

HS-022 618

August 31, 1978

- WASTELL, C.**  
THE EFFECT OF SURGICAL OPERATION ON THE  
'BRAKE-CLUTCH SIMULATOR'  
HS-022 589
- WATERMAN, DANA**  
CYBERMAN--A HUMAN FACTORS DESIGN TOOL  
HS-022 618
- WATTS, G. R.**  
THE COVERT RESPONSES OF DRIVERS TO TWO  
ROAD BASED ALERTING DEVICES  
HS-022 680  
THE DEVELOPMENT OF RUMBLE AREAS AS A  
DRIVER ALERTING DEVICE  
HS-022 686
- WEIDMAN, DEENE J.**  
THE NASA [NATIONAL AERONAUTICS AND SPACE  
ADMINISTRATION] NASTRAN STRUCTURAL ANAL-  
YSIS COMPUTER PROGRAM--NEW CONTENT  
HS-022 521
- WEIERS, RONALD M.**  
AN EXPERIMENTAL STUDY OF THE DEFENSIVE  
DRIVING COURSE  
HS-022 638
- WEISSNER, R.**  
PASSIVE VEHICLE SAFETY AS CARS GROW  
SMALLER  
HS-022 617
- WEISSNER, RUDIGER**  
A COMPARISON OF ADVANCED BELT SYSTEMS RE-  
GARDING THEIR EFFECTIVENESS  
HS-022 623
- WHALLEY, F.**  
DEFECTS IN ROAD VEHICLE BRAKING SYSTEMS--  
EXPERIENCE FROM STATUTORY INSPECTIONS  
HS-022 592
- WHEELER, WILLIAM**  
PRECISION POSITION-SENSORS IN AUTOMOTIVE  
APPLICATIONS  
HS-022 560
- WILHELM, RALPH V. , JR.**  
A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR  
HS-022 563
- WILKINS, H. A.**  
ACCIDENTS TO ARTICULATED VEHICLES FITTED  
WITH LOAD SENSING OR ANTI-LOCKING BRAKES  
TO COUNTERACT JACK-KNIFING  
HS-022 677
- WILLIAMS, A. R.**  
THE TYRE/ROAD [TIRE/ROAD] INTERFACE--ITS EF-  
FECT ON BRAKING  
HS-022 574
- WILLIAMS, ALLAN F.**  
FEASIBILITY OF DETERMINING BLOOD ALCOHOL  
CONCENTRATIONS IN SOCIAL DRINKING SETTINGS  
HS-022 649
- WILLIAMS, T.**  
WET FRICTION--TYRE [TIRE] AND ROAD [BRAKING]  
HS-022 575
- WINTER, T. E.**  
A CONTENT ANALYSIS OF FIVE BOOKS ON DRIV-  
ING  
HS-022 688
- WISE, I.**  
THE EFFECT OF SURGICAL OPERATION ON THE  
'BRAKE-CLUTCH SIMULATOR'  
HS-022 589
- WOLBER, WILLIAM G.**  
A WORLDWIDE OVERVIEW OF AUTOMOTIVE EN-  
GINE CONTROL SENSOR TECHNOLOGY  
HS-022 558
- WRIGHT, A. C. W.**  
BRAKES--A REVIEW OF EXISTING DESIGN  
HS-022 582
- WYKE SMITH, P. H.**  
VEHICLE TYPES IN RELATION TO SPECIFIC  
OPERATING CONDITIONS [UNITED KINGDOM]  
[BUSES]  
HS-022 536
- YOSHIDA, SHIGEMI**  
A SCALE MODEL SIMULATION OF VEHICLE MO-  
TIONS  
HS-022 606
- ZISKIND, R.**  
TOXIC GASES IN HEAVY DUTY DIESEL TRUCK  
CABS. FINAL REPORT  
HS-022 696
- ZUNG, BURTON J.**  
FACTOR STRUCTURE OF THE MICHIGAN ALCOHOL-  
ISM SCREENING TEST  
HS-022 648



## Corporate Author Index

- VOLVO, TECHNOLOGICAL DEVEL. DEPT.,  
VÄRNBERG, SWEDEN**  
THE INFLUENCE OF WHEEL SLIP CONTROL  
DYNAMICS ON VEHICLE STABILITY DURING BRAK-  
ING AND STEERING  
HS-022 573
- TELEFUNKEN, MARKETING SECTION, ULM,  
GERMANY**  
COLLISION AVOIDANCE SYSTEM FOR AUTOMO-  
BILES  
HS-022 614
- RED TEVES, G.M.B.H., FRANKFURT/MAIN,  
WEST GERMANY**  
DISC BRAKES FOR COMMERCIAL VEHICLES  
HS-022 600
- ARIZONA STATE UNIV.**  
DEVELOPMENT OF A BICYCLE ACCIDENT RATE IN  
ARIZONA  
HS-022 636
- COIPARI KUTATO INTEZET, BUDAPEST,  
HUNGARY**  
VEHICLE RESEARCH AND DEVELOPMENT AT AUTOKUT  
RESEARCH INSTITUTE, HUNGARY  
HS-022 540
- COMMOBILE CLUB OF SOUTHERN CALIFORNIA,  
ENGINEERING AND TECHNICAL SERVICE DIV.**  
THE TARGET CAR PROGRAM FOR 1977  
HS-022 603
- COMOTIVE PRODUCTS LTD., LEAMINGTON  
SPA, ENGLAND**  
THE DYNAMICS OF WHEEL BRAKING  
HS-022 572
- COMOTIVE PRODUCTS, LEAMINGTON SPA,  
ENGLAND**  
HYDRAULIC SUSPENSIONS WITH PARTICULAR  
REFERENCE TO PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 534
- S PRODUCTION LTD., BURTON-ON-TRENT,  
ENGLAND**  
BRAKE PERFORMANCE AND COSTS--COMMERCIAL  
VEHICLES  
HS-022 601
- GRADE UNIV., FACULTY OF MECHANICAL  
ENGINEERING [YUGOSLAVIA]**  
THEORY OF RELIABILITY AND ITS APPLICATION  
TO VEHICLE BRAKES AND BRAKING SYSTEMS  
HS-022 593
- BENDIX ELECTRONICS AND CONTROL SYSTEMS  
CORP., TROY, MICH.**  
APPLICATION OF AUTOMOTIVE SENSORS TO EN-  
GINE CONTROL  
HS-022 561
- BENDIX RES. LAB., SOUTHFIELD, MICH.**  
A WORLDWIDE OVERVIEW OF AUTOMOTIVE EN-  
GINE CONTROL SENSOR TECHNOLOGY  
HS-022 558
- BENDIX WESTINGHOUSE LTD., KINGSWOOD,  
BRISTOL, ENGLAND**  
SOME SIGNIFICANT DEVELOPMENTS IN AIR  
BRAKE SYSTEM COMPONENTS  
HS-022 580
- BICYCLE RES. ASSOCIATES, DAVIS, CALIF.**  
BICYCLE TRANSPORTATION FOR DOWNTOWN  
WORK TRIPS: A CASE STUDY IN DAVIS, CALIFOR-  
NIA  
HS-022 633
- BIOTECHNOLOGY, INC., FALLS CHURCH, VA.**  
ACCIDENT DATA BASE FOR URBAN PEDESTRIANS  
HS-022 632
- KNOWLEDGE AND PERCEPTIONS OF YOUNG  
PEDESTRIANS**  
HS-022 629
- PEDESTRIAN SIGNAL DISPLAYS: AN EVALUATION  
OF WORD MESSAGE AND OPERATION**  
HS-022 630
- SKILL TRAINING FOR COLLISION AVOIDANCE**  
HS-022 640
- BRANSON SONIC POWER CO., EAGLE RD.,  
DANBURY, CONN. 06810**  
NEW DESIGNS THROUGH VIBRATION WELDING  
HS-022 687
- BRITISH LEYLAND TRUCK AND BUS GROUP,  
ENGLAND**  
THE CHOICE OF MATERIALS IN THE DESIGN AND  
CONSTRUCTION OF PUBLIC SERVICE VEHICLES  
[BUSES]  
HS-022 541
- BRITISH LEYLAND UK LTD., TRUCK AND BUS  
GROUP, ENGLAND**  
A REVIEW OF COMMERCIAL VEHICLE BRAKES  
HS-022 599
- BUDD CO.**  
RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3A:  
SUBCONTRACTOR FINAL REPORTS. FINAL REPORT  
HS-803 251
- CALIFORNIA DEPT. OF TRANSPORTATION,  
OFFICE OF TRAFFIC, 1120 N ST., SACRAMENTO,  
CALIF. 95814**  
ACCIDENT RATES VS SHOULDER WIDTHS. FINAL  
REPORT  
HS-022 525
- CALSPAN CORP., BUFFALO, N.Y. 14221**  
EVALUATION OF TEST DUMMY'S FLESH PARTS  
PRODUCED WITH SUBSTITUTE FOAMING COM-  
POUNDS. MONTHLY PROGRESS REPORT NO. 8, 1 OC-  
TOBER TO 31 OCTOBER 1977  
HS-803 313

NOVEMBER TO 30 NOVEMBER 1977	HS-803 318	DEPARTMENT OF THE ENVIRONMENT, ENGLAND 'AWARE,' AN IN-VEHICLE VISUAL COMMUNICATION SYSTEM FOR DRIVERS	HS-022 522
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 10, 1 DECEMBER TO 31 DECEMBER 1977	HS-803 319	A CONTENT ANALYSIS OF FIVE BOOKS ON DRIVING	HS-022 685
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 11, 1 JANUARY TO 31 JANUARY 1978	HS-803 320	A REANALYSIS OF CALIFORNIA DRIVER VISION DATA: GENERAL FINDINGS	HS-022 688
EVALUATION OF TEST DUMMY'S FLESH PARTS PRODUCED WITH SUBSTITUTE FOAMING COMPOUNDS. MONTHLY PROGRESS REPORT NO. 12, 1 FEBRUARY TO 28 FEBRUARY 1978	HS-803 321	A STUDY OF MALE MOTORISTS' ATTITUDES TO SPEED RESTRICTIONS AND THEIR ENFORCEMENT	HS-022 675
<b>CHAMPION SPARK PLUG CO.</b> HOW PASSENGER CAR MAINTENANCE AFFECTS FUEL ECONOMY AND EMISSIONS. A NATIONWIDE SURVEY	HS-022 517	A STUDY OF ROAD ACCIDENTS IN SELECTED URBAN AREAS IN DEVELOPING COUNTRIES	HS-022 682
<b>CHIEF MEDICAL EXAMINER-CORONER, HALL OF JUSTICE, LOS ANGELES, CALIF. 90012</b> NECK INJURY ASSESSMENT PROTOCOL. FINAL REPORT	HS-803 287	ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING	HS-022 677
<b>CHRYSLER CORP., DESIGN OFFICE</b> CYBERMAN--A HUMAN FACTORS DESIGN TOOL	HS-022 618	AN INTERVIEW SURVEY OF MOTORWAY DRIVER INFORMATION REQUIREMENTS AND SIGNAL UNDERSTANDING	HS-022 673
<b>CLAYTON DEWANDRE CO. LTD., LINCOLN, ENGLAND</b> NON-RIGID VEHICLE BRAKING SYSTEMS	HS-022 569	BEHAVIOUR OF DRIVERS ON YELLOW BAR PATTERNS - EXPERIMENT ON ALTON BY-PASS, HAMPSHIRE	HS-022 679
<b>CLAYTON DEWANDRE CO., LTD., LINCOLN, ENGLAND</b> HEATING AND VENTILATING [OF BUSES] IN U.K. [UNITED KINGDOM]	HS-022 532	MALE AND FEMALE CAR DRIVERS: DIFFERENCES OBSERVED IN ACCIDENTS	HS-022 674
<b>CRANFIELD INST. OF TECH., SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, BEDS., ENGLAND</b> INVESTIGATION OF PSV [PUBLIC SERVICE VEHICLE] ROLL OVER SAFETY [BUSES]	HS-022 535	RECOGNITION DISTANCES OF VEHICLE REAR MARKINGS AT NIGHT	HS-022 689
<b>DAIMLER-BENZ AG, TEST DEPT., STUTTGART, WEST GERMANY</b> EVALUATION OF THE BRAKING PERFORMANCE OF PASSENGER CARS WITH FIXED AND WITH 'KINKED' BRAKE-FORCE DISTRIBUTIONS	HS-022 577	ROAD ACCIDENTS AS A CAUSE OF DEATH IN DEVELOPING COUNTRIES	HS-022 683
<b>DAIMLER-BENZ AKTIENGESELLSCHAFT, STUTTGART, GERMANY</b> ANALYTICAL COMPARISON OF INTEGRAL AND CHASSIS DESIGN ON BUSES	HS-022 539	SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT STUDY AMONGST CHILDREN	HS-022 684
		THE COVERT RESPONSES OF DRIVERS TO TWO ROAD BASED ALERTING DEVICES	HS-022 680
		THE DEVELOPMENT OF RUMBLE AREAS AS A DRIVER ALERTING DEVICE	HS-022 686
		THE EFFECT OF VEHICLE AND ROAD CHARACTERISTICS ON COMMERCIAL VEHICLE SPEEDS IN ETHIOPIA	HS-022 681
		<b>DEPARTMENT OF THE ENVIRONMENT, NORTH WESTERN TRAFFIC AREA [ENGLAND]</b> DEFECTS IN ROAD VEHICLE BRAKING SYSTEMS--EXPERIENCE FROM STATUTORY INSPECTIONS	HS-022 592

DURING THE PAST DECADE	HS-022 597	RECOGNITION DISTANCES OF VEHICLE REAR MARKINGS AT NIGHT	HS-022 689
<b>DEPARTMENT OF THE ENVIRONMENT, TRANSPORT AND ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND</b>		<b>DEPARTMENT OF TRANSPORT, VEHICLE INSPECTION DIV., LONDON, ENGLAND</b>	
WET FRICTION--TYRE [TIRE] AND ROAD [BRAKING] DATA	HS-022 575	STATUTORY TECHNICAL CONTROL OF PUBLIC SERVICE VEHICLES [BUSES] [UNITED KINGDOM]	HS-022 531
ACCIDENTS INVOLVING LOSS OF CONTROL WHEN BRAKING - A STUDY OF THE ON-THE-SPOT SURVEY DATA	HS-022 588	<b>DETROIT DIESEL ALLISON INTERNATIONAL, WELLINGBOROUGH, ENGLAND</b>	
BRAKE DEFECTS IN CARS	HS-022 591	ALLISON AUTOMATIC TRANSMISSIONS FOR PUBLIC SERVICE VEHICLES [BUSES]	HS-022 538
<b>DEPARTMENT OF TRANSPORT, TRANSPORT AND ROAD RES. LAB., CROWTHORNE, BERKS., ENGLAND</b>		<b>DUNLAP AND ASSOCIATES, INC., 1 PARKLAND DRIVE, DARIEN, CONN. 06820</b>	
AN INTERVIEW SURVEY OF MOTORWAY DRIVER INFORMATION REQUIREMENTS AND SIGNAL UNDERSTANDING	HS-022 673	EVALUATION OF SCREENING BREATH TESTING IN TRAFFIC LAW ENFORCEMENT. FINAL REPORT	HS-803 274
MALE AND FEMALE CAR DRIVERS: DIFFERENCES OBSERVED IN ACCIDENTS	HS-022 674	<b>DUNLOP LTD., BIRMINGHAM, ENGLAND</b>	
A REANALYSIS OF CALIFORNIA DRIVER VISION DATA: GENERAL FINDINGS	HS-022 675	THE TYRE/ROAD [TIRE/ROAD] INTERFACE--ITS EFFECT ON BRAKING	HS-022 574
A STUDY OF ROAD ACCIDENTS IN SELECTED URBAN AREAS IN DEVELOPING COUNTRIES	HS-022 676	<b>DUNLOP LTD., SUSPENSIONS DIV., COVENTRY, ENGLAND</b>	
ACCIDENTS TO ARTICULATED VEHICLES FITTED WITH LOAD SENSING OR ANTI-LOCKING BRAKES TO COUNTERACT JACK-KNIFING	HS-022 677	DESIGN, CONSTRUCTION AND APPLICATION OF AIR SPRINGS FOR PSV [PUBLIC SERVICE VEHICLE] SUSPENSION [BUSES]	HS-022 533
BEHAVIOUR OF DRIVERS ON YELLOW BAR PATTERNS - EXPERIMENT ON ALTON BY-PASS, HAMPSHIRE	HS-022 679	<b>ECHLIN MFG. CO.</b>	
THE COVERT RESPONSES OF DRIVERS TO TWO ROAD BASED ALERTING DEVICES	HS-022 680	THE WIEGAND EFFECT AND ITS AUTOMOTIVE APPLICATIONS	HS-022 559
THE EFFECT OF VEHICLE AND ROAD CHARACTERISTICS ON COMMERCIAL VEHICLE SPEEDS IN ETHIOPIA	HS-022 681	<b>ENERGY RES. AND DEVEL. ADMINISTRATION, DIV. OF TRANSPORTATION ENERGY CONSERVATION, WASHINGTON, D.C.</b>	
A STUDY OF MALE MOTORISTS' ATTITUDES TO SPEED RESTRICTIONS AND THEIR ENFORCEMENT	HS-022 682	AN ASSESSMENT OF THE TECHNOLOGY OF RANKINE ENGINES FOR AUTOMOBILES	HS-022 647
ROAD ACCIDENTS AS A CAUSE OF DEATH IN DEVELOPING COUNTRIES	HS-022 683	<b>ENERGY RES. AND DEVEL. ADMINISTRATION, WASHINGTON, D.C. 20545</b>	
SAFETY HELMETS FOR PEDAL CYCLISTS - A PILOT STUDY AMONGST CHILDREN	HS-022 684	ELECTRIC VEHICLE SYSTEMS FY 1978. ENVIRONMENTAL DEVELOPMENT PLAN	HS-022 645
'AWARE,' AN IN-VEHICLE VISUAL COMMUNICATION SYSTEM FOR DRIVERS	HS-022 685	<b>EXXON ENTERPRISES INC.</b>	
THE DEVELOPMENT OF RUMBLE AREAS AS A DRIVER ALERTING DEVICE	HS-022 686	ECONOMIC COMPARISON OF FUTURE AUTOMOTIVE POWER SYSTEMS	HS-022 518
		<b>FEDERAL HWY. ADMINISTRATION</b>	
		CITIZEN PARTICIPATION IN PLANNING AND DESIGNING BIKEWAYS	HS-022 634
		<b>FEDERAL HWY. ADMINISTRATION, TRAFFIC SYSTEMS DIV., WASHINGTON, D.C. 20590</b>	
		HIGHWAY ADVISORY RADIO IN CONSTRUCTION AREAS. FINAL REPORT	HS-022 697



- A STATUS REPORT ON VEHICLE DETECTORS.  
FINAL REPORT  
HS-022 698
- FEDERAL HWY. ADMINISTRATION,  
WASHINGTON, D.C. 20590**  
THE 1979 ESTIMATE OF THE COST OF COMPLETING  
THE INTERSTATE SYSTEM. INSTRUCTION MANUAL  
FOR PREPARATION AND SUBMISSION  
HS-022 553
- FERODO LTD., CHAPEL-EN-LE-FRITH, DERBY,  
ENGLAND**  
A THEORY OF DRUM BRAKE SQUEAL  
HS-022 585  
CAST IRON BRAKE ROTOR METALLURGY  
HS-022 581
- FORD MOTOR CO.**  
APPLICATION OF A CRANKSHAFT POSITION SEN-  
SOR TO CONTROL ENGINE TIMING  
HS-022 564  
USING COMPUTER SIMULATION TO EVALUATE  
AND IMPROVE VEHICLE HANDLING  
HS-022 513
- FORD MOTOR CO., ALLEN PARK, MICH.**  
THE FIRST PRODUCTION AUTOMOTIVE CAPACI-  
TIVE PRESSURE SENSOR  
HS-022 565
- FORD MOTOR CO., ELECTRICAL AND  
ELECTRONICS DIV.**  
TEMPERATURE SENSORS FOR ELECTRONIC EN-  
GINE CONTROL SYSTEMS  
HS-022 562
- FORD MOTOR CO., LAINDON, ESSEX, ENGLAND**  
LEGISLATIVE CONTROL OF ARTICULATED VEHI-  
CLE BRAKING [EUROPE]  
HS-022 595
- FORD MOTOR CO., RES. STAFF, DEARBORN,  
MICH.**  
DESIGN CONSIDERATIONS IN ENERGY ABSORP-  
TION BY STRUCTURAL COLLAPSE  
HS-022 624
- GENERAL MOTORS CORP., BUICK MOTOR DIV.**  
AN OVERALL DESIGN APPROACH TO IMPROVING  
PASSENGER CAR FUEL ECONOMY  
HS-022 605
- GENERAL MOTORS CORP., RES. LAB.**  
A ZIRCONIA-BASED LEAN AIR-FUEL RATIO SENSOR  
HS-022 638
- GENERAL MOTORS RES. LABS.**  
TARGET IDENTIFICATION CAPABILITY OF SWEPT  
FREQUENCY AUTOMOBILE RADAR  
HS-022 613
- GENERAL RES. CORP., SANTA BARBARA, CALIF.**  
BASIC REQUIREMENTS FOR URBAN CARS  
HS-022 610
- GIRLING CONTINENTAL OPERATIONS**  
PARAMETERS FOR THE USE OF DISC BRAKES IN-  
CORPORATING AUTOMATICALLY ADJUSTED HAND-  
BRAKE MECHANISMS  
HS-022 620
- GIRLING LTD., BIRMINGHAM, ENGLAND**  
BRAKING REGULATIONS IN EUROPE  
HS-022 596
- GIRLING LTD., KINGS RD., TYSELEY,  
BIRMINGHAM B11 2AH, ENGLAND**  
PRACTICAL ASPECTS OF TESTING ANTI-LOCK  
SYSTEMS ON COMMERCIAL VEHICLES  
HS-022 579
- GIRLING LTD., KINGS RD., TYSELEY,  
BIRMINGHAM, ENGLAND**  
BRAKES--A REVIEW OF EXISTING DESIGN  
HS-022 582
- GIRLING UK**  
PARAMETERS FOR THE USE OF DISC BRAKES IN-  
CORPORATING AUTOMATICALLY ADJUSTED HAND-  
BRAKE MECHANISMS  
HS-022 620
- GIRLING, LTD., KINGS RD., TYSELEY,  
BIRMINGHAM, ENGLAND**  
BRAKING SYSTEMS FOR RIGID VEHICLES  
HS-022 568
- GKN WINDSOR G.M.B.H.**  
DESIGN INNOVATIONS FACILITATING ECONOMIC  
PRODUCTION OF GIANT MOULDINGS  
HS-022 552
- GOODYEAR TIRE AND RUBBER CO.**  
THE ADHESIVE TESTING OF HIGH STRENGTH  
LAMINATES FOR STRUCTURAL DURABILITY  
HS-022 678
- GRH CONSULTING, FAIRFAX, VA.**  
SKILL TRAINING FOR COLLISION AVOIDANCE  
HS-022 640
- IDAHO TRANSPORTATION DEPT., BOISE**  
EFFECT OF BICYCLE LANE USAGE ON VEHICLES  
IN THE ADJACENT LANE  
HS-022 637
- INDIANA UNIV. OF PENNSYLVANIA, SCHOOL OF  
BUSINESS**  
AN EXPERIMENTAL STUDY OF THE DEFENSIVE  
DRIVING COURSE  
HS-022 638
- INSTITUTE OF GAS TECHNOLOGY, CHICAGO,  
ILL. 60616**  
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANS-  
PORTATION--A FEASIBILITY STUDY. VOL. 1--EX-  
ECUTIVE SUMMARY  
HS-022 643  
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANS-  
PORTATION --A FEASIBILITY STUDY. VOL. 2--  
TECHNICAL SECTION  
HS-022 644

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BRAKING OF ROAD VEHICLES. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIVISION, IN ASSOCIATION WITH THE INSTITUTE OF ROAD TRANSPORT ENGINEERS, LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND, 23-25 MAR 1976

HS-022 566

**INSTITUTION OF MECHANICAL ENGINEERS, LONDON, ENGLAND**

THE DESIGN, CONSTRUCTION AND OPERATION OF PUBLIC SERVICE VEHICLES [BUSES]. CONFERENCE SPONSORED BY THE INSTITUTION OF MECHANICAL ENGINEERS, AUTOMOBILE DIV., AND SCHOOL OF AUTOMOTIVE STUDIES, CRANFIELD, ENGLAND, 11-13 JUL 1977

HS-022 527

**JAPAN AUTOMOBILE RES. INST., INC. [JAPAN]**  
DYNAMIC CORNERING PROPERTIES OF TIRES

HS-022 607

THE EFFECT OF HYDROPLANING ON THE DYNAMIC CHARACTERISTICS OF CAR, TRUCK AND BUS TIRES

HS-022 608

**JAPAN AUTOMOBILE RES. INST., INC.**

A DATA RECORDING SYSTEM OF THE PATH OF A TEST VEHICLE BY LASER BEAM AND SOME APPLICATIONS TO STEERING HANDLING TEST

HS-022 520

**JHK AND ASSOCIATES, ALEXANDRIA, VA.**

SELECTION OF PEDESTRIAN SIGNAL PHASING

HS-022 627

**KAVLICO CORP., CHATSWORTH, CALIF.**

THE FIRST PRODUCTION AUTOMOTIVE CAPACITIVE PRESSURE SENSOR

HS-022 565

**KLD ASSOCIATES, INC., HUNTINGTON STATION, N.Y.**

PEDESTRIAN DELAY AND PEDESTRIAN SIGNAL WARRANTS

HS-022 628

**LEYLAND TRUCK AND BUS CO., PRESTON, ENGLAND**

ENVIRONMENTAL REQUIREMENTS FOR PSV [PUBLIC SERVICE VEHICLE] OPERATION [BUSES]

HS-022 530

**LONDON TRANSPORT, ACTON WORKS, 130 BOLLO LANE, LONDON W3, ENGLAND**

HYDRAULIC SUSPENSIONS WITH PARTICULAR REFERENCE TO PUBLIC SERVICE VEHICLES [BUSES]

HS-022 534

**LOUGHBOROUGH UNIV. OF TECHNOLOGY, LEICS., ENGLAND**

BASIC PRINCIPLES [VEHICLE BRAKING]

HS-022 567

**LOUGHBOROUGH UNIV. OF TECHNOLOGY, LOUGHBOROUGH, LEICS., ENGLAND**

LATERAL STABILITY OF COMMERCIAL ROAD VEHICLE TRAINS UNDER BRAKING CONDITIONS

HS-022 570

**LOUGHBOROUGH UNIV., INST. FOR CONSUMER ERGONOMICS, ENGLAND**

A DESIGN AND EVALUATION STUDY OF HAND-HOLDS AND FOOTHOLDS FOR EMERGENCY WINDOWS OF CLASS III PUBLIC SERVICE VEHICLES [BUSES]

HS-022 529

**MAN FACTORS, INC.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3A: SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 251

**MARC ANALYSIS RES. CORP.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3A: SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 251

**MARQUETTE UNIV., DEPT. OF CIVIL ENGINEERING**

A METHOD FOR ESTIMATING PEDESTRIAN VOLUME IN A CENTRAL BUSINESS DISTRICT

HS-022 631

**MECHANICAL ENGINEERING LAB. [JAPAN]**

A SCALE MODEL SIMULATION OF VEHICLE MOTIONS

HS-022 606

**MICHIGAN STATE UNIV., DEPT. OF COMMUNITY MEDICINE**

ARE PEOPLE STILL GETTING BIGGER--WHO, WHERE, AND HOW MUCH? [DESIGN OF AUTOMOTIVE EQUIPMENT]

HS-022 616

**MINICARS, INC., 35 LA PATERA LANE, GOLETA, CALIF. 93017**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 1: EXECUTIVE SUMMARY. FINAL REPORT

HS-803 249

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 2: COMPREHENSIVE TECHNICAL RESULTS. FINAL REPORT

HS-803 250

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3A: SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 251

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3B: SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 252

**MITSUBISHI MOTORS CORP. [JAPAN]**

ENERGY ABSORPTION BY THE PLASTIC DEFORMATION OF BODY STRUCTURAL MEMBERS

HS-022 622

**MONSANTO RES. CORP.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3A: SUBCONTRACTOR FINAL REPORTS. FINAL REPORT

HS-803 251

**MOTOR INDUSTRY RES. ASSOC., NUNEATON, ENGLAND**

DISC BRAKE SQUEAL

HS-022 584

**MOTOR INDUSTRY RES. ASSOC., WALLING ST., NUNEATON, WARWICK, ENGLAND**

THE NATIONAL PSV [PUBLIC SERVICE VEHICLE] ACCIDENT SURVEY: A VEHICLE DESIGN ORIENTED STUDY [BUSES]

HS-022 544

**MOTOR VEHICLE MANUFACTURERS ASSOC. OF THE UNITED STATES, INC.**

THE 1980'S: CHALLENGES OF CHANGE CONFRONTING THE MOTOR VEHICLE AND FREEDOM OF MOBILITY

HS-022 547

**NATIONAL ACAD. OF SCIENCES, TRANSPORTATION RES. BOARD, WASHINGTON, D.C.**

PEDESTRIAN CONTROLS, BICYCLE FACILITIES, DRIVER RESEARCH, AND SYSTEM SAFETY

HS-022 626

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, LANGLEY RES. CENTER**

THE NASA [NATIONAL AERONAUTICS AND SPACE ADMINISTRATION] NASTRAN STRUCTURAL ANALYSIS COMPUTER PROGRAM--NEW CONTENT

HS-022 521

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, LEWIS RES. CENTER, CLEVELAND, OHIO**

TEST AND EVALUATION OF 23 ELECTRIC VEHICLES FOR STATE-OF-THE-ART ASSESSMENT

HS-022 619

**NATIONAL BUS CO., LONDON, ENGLAND**

OPERATIONAL VIEWS AND REQUIREMENTS FOR MAINTENANCE, REPAIR AND EFFECTIVENESS OF BRAKES

HS-022 590

VEHICLE TYPES IN RELATION TO SPECIFIC OPERATING CONDITIONS [UNITED KINGDOM] [BUSES]

HS-022 536

**NATIONAL BUS CO., 25 NEW ST. SQUARE, LONDON, ENGLAND**

PROSPECTS FOR BUS AND COACH TRANSPORT [UNITED KINGDOM]

HS-022 528

**NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION, TIRE SYSTEMS DIV., RIVERDALE, MD.**

THE USE OF THE MOBILE TIRE TRACTION DYNAMOMETER IN RESEARCH

HS-022 609

**NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION, WASHINGTON, D.C. 20590**

IMPACT OF DIAGNOSTIC INSPECTION ON AUTOMOTIVE FUEL ECONOMY AND EMISSIONS

HS-022 515

**REPAIR INDUSTRY RESPONSE TO DIAGNOSTIC INSPECTION PROJECTS**

HS-022 516

**NATIONAL HIGHWAY SAFETY ADVISORY COMMITTEE ON ALCOHOL SAFETY ADJUDICATION. FINAL REPORT**

HS-802 510

**COMPILATION OF REPORTS GENERATED BY THE TIRE SYSTEMS DIVISION, SAFETY RESEARCH LABORATORY, 1967 THRU JANUARY 1978. PRELIMINARY REPORT**

HS-803 312

**STATEMENT AT THE NATIONAL PRESS CLUB, WASHINGTON, D.C., THURSDAY, SEPT. 1, 1977**

HS-810 314

**NATIONAL SAFETY COUNCIL, STATISTICS DEPT., 444 N. MICHIGAN AVE., CHICAGO, ILL. 60611**

MOTORCYCLE FACTS, NOVEMBER, 1977

HS-022 656

**NATIONAL TRANSPORTATION SAFETY BOARD  
CRASH SAFETY FOR RAILROAD PASSENGERS, TRAIN CREWS AND GRADE CROSSING CRASH VICTIMS**

HS-022 514

**NEW ENGLAND INSTRUMENT CO., RES. AND DEVEL. DEPT., NATICK, MASS.**

PRECISION POSITION-SENSORS IN AUTOMOTIVE APPLICATIONS

HS-022 560

**OREGON STATE UNIV., DEPT. OF CIVIL ENGINEERING**

EFFECT OF BICYCLE LANE USAGE ON VEHICLES IN THE ADJACENT LANE

HS-022 637

**PENNSYLVANIA DEPT. OF TRANSPORTATION, GOVERNOR'S TRAFFIC SAFETY COUNCIL, HARRISBURG, PA. 17120**

ANALYSIS OF THE MANDATORY MOTORCYCLE HELMET ISSUE

HS-022 694

**PLANNING ENVIRONMENT INTERNATIONAL, MCLEAN, VA.**

EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION PLANNING/PROGRAMMING ISSUES, TECHNIQUES, AND THEIR RELATIONSHIPS

HS-022 550

**POLYTECHNIC INST. OF NEW YORK, DEPT. OF TRANSPORTATION PLANNING AND ENGINEERING  
SYSTEM-SAFETY TECHNIQUES USEFUL FOR TRANSPORTATION SAFETY**

HS-022 641

**PUBLIC TECHNOLOGY, INC., 1140 CONNECTICUT AVE., N.W., WASHINGTON, D.C. 20036**

TRANSPORTATION FOR ELDERLY AND HANDICAPPED PERSONS

HS-022 554

**NEW STANDARD BUS EQUIPMENT**

HS-022 555

**TRAFFIC SIGNALIZATION SYSTEMS**

HS-022 556

August 31, 1978

**RCA LABS.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3B:  
SUBCONTRACTOR FINAL REPORTS. FINAL REPORT  
HS-803 252

**RENAULT TECHNICAL CENTER, BELLEVILLE,  
MICH.**

EFFICIENT VEHICLE PACKAGING WITH FRONT-  
WHEEL DRIVE  
HS-022 604

**RENAULT, FRANCE**

EFFICIENT VEHICLE PACKAGING WITH FRONT-  
WHEEL DRIVE  
HS-022 604

**RES. INST. OF AUTOMOBILE INDUSTRY,  
BUDAPEST, HUNGARY**

PLASTIC DEFORMATIONS AND ENERGY CONSUMP-  
TION AT DYNAMIC (IMPACT) LOADS  
HS-022 543

**ROBERT BOSCH G.M.B.H., STUTTGART,  
GERMANY**

COLLISION AVOIDANCE SYSTEM FOR AUTOMO-  
BILES  
HS-022 614

**ROCHESTER GENERAL HOSP., DEPT. OF  
ORTHOPEDICS**

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE  
BOLSTER RESTRAINT, VWRA--A PRELIMINARY  
FIELD PERFORMANCE EVALUATION--PROGRESS  
REPORT  
HS-022 625

**ROCKWELL INTERNATIONAL**

RELIABILITY, MAINTAINABILITY, SAFETY AND  
HUMAN FACTOR (RMSH) CONSIDERATIONS IN THE  
AUTOMOTIVE INDUSTRY  
HS-022 519

**ROYAL ELECTRICAL AND MECHANICAL  
ENGINEERS [ENGLAND]**

RELIABILITY AND MAINTAINABILITY OF BRAKING  
SYSTEMS--MILITARY APPLICATIONS  
HS-022 594

**ROYAL ULSTER CONSTABULARY, TRAFFIC DIV.  
HEADQUARTERS, ALEXANDER RD., BELFAST,  
NORTHERN IRELAND**

DEATH AND INJURY ROAD ACCIDENTS IN  
NORTHERN IRELAND 1976  
HS-022 693

**S.A.F. FERODO, PARIS, FRANCE**

RECENT PROGRESS IN BRAKING TESTS BY USE OF  
A CAR DYNAMOMETER  
HS-022 583

**SCIENCE APPLICATIONS, INC., 1801 AVE. OF THE  
STARS, SUITE 1205, LOS ANGELES, CALIF. 90067**

TOXIC GASES IN HEAVY DUTY DIESEL TRUCK  
CABS. FINAL REPORT  
HS-022 696

**SHELL RES. LTD., THORNTON RES. CENTRE,  
CHESTER, ENGLAND**

FUEL ECONOMY OF THE GASOLINE ENGINE.  
FUEL, LUBRICANT AND OTHER EFFECTS  
HS-022 661

MILEAGE MARATHONS [FUEL ECONOMY]

HS-022 672

MOTOR GASOLINE AND THE EFFECT OF COMPRES-  
SION RATIO ON OCTANE REQUIREMENT AND FUEL  
ECONOMY  
HS-022 663

PRINCIPLES GOVERNING FUEL ECONOMY IN A  
GASOLINE ENGINE  
HS-022 662

THE EFFECT OF THE PHYSICAL PROPERTIES OF  
GASOLINE ON FUEL ECONOMY  
HS-022 664

THE EFFECT OF GASOLINE ADDITIVES ON FUEL  
ECONOMY  
HS-022 665

THE EFFECT OF MIXTURE PREPARATION ON FUEL  
ECONOMY  
HS-022 666

THE EFFECT OF VEHICLE MAINTENANCE ON FUEL  
ECONOMY  
HS-022 667

THE EFFECT OF EMISSION CONTROLS ON FUEL  
ECONOMY  
HS-022 668

THE MEASUREMENT OF FUEL ECONOMY

HS-022 669

THE EFFECT OF CRANKCASE LUBRICANTS ON  
FUEL ECONOMY  
HS-022 670

THE EFFECT OF TRANSMISSION LUBRICANTS ON  
FUEL ECONOMY  
HS-022 671

**SOCIETY OF AUTOMOTIVE ENGINEERS, 400  
COMMONWEALTH DRIVE, WARRENDALE, PA.  
15096**

AUTOMOTIVE APPLICATIONS OF SENSORS

HS-022 557

**SOUTHERN CALIFORNIA ASSOC. OF  
GOVERNMENTS, 600 S. COMMONWEALTH AVE.,  
SUITE 1000, LOS ANGELES, CALIF. 90005**

PLANNING FOR THE AUTOMOBILE IN THE SCAG  
[SOUTHERN CALIFORNIA ASSOCIATION OF  
GOVERNMENTS] REGION. AN EVALUATION OF AL-  
TERNATIVES FOR REDUCING AUTOMOBILE EMIS-  
SIONS AND FUEL CONSUMPTION  
HS-022 650

**SPICER ENGINEERING CO., SAGINAW, MICH.**

A METHOD FOR ESTIMATING PEDESTRIAN  
VOLUME IN A CENTRAL BUSINESS DISTRICT  
HS-022 631

**SPURRIER WORKS, LEYLAND, PRESTON,  
ENGLAND**

BRAKING BUSES

HS-022 537

**STANFORD RES. INST.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3B:  
SUBCONTRACTOR FINAL REPORTS. FINAL REPORT  
HS-803 252

**STATE OF MAINE DEPT. OF TRANSPORTATION,  
MATERIAL AND RES. DIV., BOX 1208, HOGAN RD.,  
BANGOR, MAINE 04401**

ENERGY USE AND OTHER COMPARISONS  
BETWEEN DIESEL AND GASOLINE PICKUP  
TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977  
HS-022 548

**STATE UNIV. OF NEW YORK, BUFFALO**

EVALUATING THE IMPACT OF WEATHER ON BICY-  
CLE USE  
HS-022 635

**STORCH ENGINEERS, 824 BOYLSTON ST.,  
CHESTNUT HILL, MASS. 02167**

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 1: OVERVIEW, TECHNOLOGY  
SURVEY AND RELAY ALTERNATIVES. FINAL RE-  
PORT  
HS-022 691

**STRUCTURAL DYNAMICS RES. CORP.**

DYNAMIC SIMULATION OF AN AUTOMOBILE BODY  
UTILIZING FINITE ELEMENT AND MODAL SYNTHESIS  
TECHNIQUES  
HS-022 621

**SYSTEM DESIGN CONCEPTS, INC., WASHINGTON,  
D.C.**

EVALUATING OPTIONS IN STATEWIDE TRANSPORTATION  
PLANNING/PROGRAMMING ISSUES,  
TECHNIQUES, AND THEIR RELATIONSHIPS  
HS-022 550

**SYSTEMS TECHNOLOGY, INC.**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3B:  
SUBCONTRACTOR FINAL REPORTS. FINAL REPORT  
HS-803 252

**TEXAS DEPT. OF PUBLIC SAFETY**

MOTOR VEHICLE TRAFFIC ACCIDENTS 1976  
HS-022 524

**THERMO ELECTRON CORP., 101 FIRST AVE.,  
WALTHAM, MASS. 02154**

FEASIBILITY TEST ON COMPOUNDING THE INTERNAL  
COMBUSTION ENGINE FOR AUTOMOTIVE  
VEHICLES, TASK 2. FINAL REPORT  
HS-022 646

**TRANSPORTATION SYSTEMS CENTER, KENDALL  
SQUARE, CAMBRIDGE, MASS. 02142**

ENERGY USE AND OTHER COMPARISONS  
BETWEEN DIESEL AND GASOLINE PICKUP  
TRUCKS. INTERIM REPORT, OCT 1976 - JUN 1977  
HS-022 548

WORKSHOPS ON TRANSPORTATION-AIR QUALITY  
RESEARCH NEEDS FOR STATE, REGIONAL, AND  
LOCAL GOVERNMENT OFFICIALS. FINAL REPORT  
HS-022 642

AUTOMOTIVE FLEET FUEL CONSUMPTION MODEL:  
FUEL FOR FINAL REPORT

**UNIROYAL TIRE CO.**

SOURCES OF ROLLING RESISTANCE IN RADIAL  
PLY TIRES  
HS-022 612

**UNIV. OF CALIFORNIA, DAVIS**

BICYCLE TRANSPORTATION FOR DOWNTOWN  
WORK TRIPS: A CASE STUDY IN DAVIS, CALIFOR-  
NIA  
HS-022 633

**UNIV. OF MICHIGAN**

EVALUATION OF MEETING BEAMS OF TWO- AND  
THREE-BEAM HEADLIGHTING SYSTEMS  
HS-022 700

**UNIV. OF UTAH**

RESEARCH SAFETY VEHICLE--PHASE 2. VOL. 3B:  
SUBCONTRACTOR FINAL REPORTS. FINAL REPORT  
HS-803 252

**UNIVERSITY OF ILLINOIS AT URBANA-  
CHAMPAIGN**

EVALUATION OF MEETING BEAMS OF TWO- AND  
THREE-BEAM HEADLIGHTING SYSTEMS  
HS-022 700

**UNIVERSITY OF ILLINOIS, DEPT. OF HEALTH AND  
SAFETY EDUCATION, CHAMPAIGN, ILL. 61820**

IMPLICATIONS OF SOME CHARACTERISTICS OF  
DRIVERS FOR BRAKE SYSTEM PERFORMANCE  
HS-022 586

**UNIVERSITY OF LEEDS, ENGLAND**

THE STABILITY OF MOTORCYCLES IN ACCELERATION  
AND DECELERATION  
HS-022 571

**UNIVERSITY OF LOWELL RES. FOUNDATION, 450  
AIKEN ST., LOWELL, MASS. 01854**

POTENTIAL MEANS OF COST REDUCTION IN  
GRADE CROSSING MOTORIST-WARNING CONTROL  
EQUIPMENT. VOL. 2: COMPARISON OF SOLID STATE  
AND RELAY DEVICES AND TECHNIQUES. FINAL  
REPORT  
HS-022 692

**UNIVERSITY OF MELBOURNE, DEPT. OF  
OPTOMETRY, AUSTRALIA**

STUDY OF MOTOR VEHICLE SIGNAL SYSTEMS.  
FINAL REPORT  
HS-022 690

**UNIVERSITY OF MICHIGAN, GRADUATE SCHOOL  
OF BUSINESS ADMINISTRATION**

CONSUMER ACCEPTANCE OF DOWN-SIZED AU-  
TOMOBILES  
HS-022 523

**UNIVERSITY OF MICHIGAN, HWY. SAFETY RES.  
INST., ANN ARBOR, MICH.**

COMPUTER ANALYSIS OF ANTILOCK SYSTEM PER-  
FORMANCE IN THE BRAKING OF COMMERCIAL  
VEHICLES  
HS-022 578

August 31, 1978

**UNIVERSITY OF MICHIGAN, HWY. SAFETY RES.  
INST., ANN ARBOR, MICH. 48109**

HIGH-SPEED CINERADIOGRAPHIC EQUIPMENT FOR  
BIOSCIENCES RESEARCH: FINAL TECHNICAL  
LETTER REPORT ON NSF [NATIONAL SCIENCE  
FOUNDATION] PROGRAM

HS-022 701

THE RELATIVE MERITS OF DIFFERENT LOW BEAM  
HEADLIGHTING SYSTEMS - A REVIEW OF THE  
LITERATURE. FINAL REPORT

HS-022 704

**UNIVERSITY OF MICHIGAN, HWY. SAFETY RES.  
LAB., ANN ARBOR, MICH.**

MEASUREMENTS OF THE LONGITUDINAL AND  
LATERAL TRACTION PROPERTIES OF TRUCK TIRES

HS-022 576

**UNIVERSITY OF SOUTH DAKOTA, HUMAN  
FACTORS LAB., VERMILLION, S. DAK. 57069**

INTERIM ANALYSIS OF STR [SHORT TERM REHA-  
BILITATION] PERFORMANCE AND EFFECTIVENESS.  
TWELVE-MONTH ANALYSES

HS-803 285

**UNIVERSITY OF SOUTHERN CALIFORNIA,  
TRAFFIC SAFETY CENTER**

MEASURING THE OUTCOMES OF DRIVER TRAIN-  
ING: UNIVERSITY OF SOUTHERN CALIFORNIA  
DRIVER PERFORMANCE TEST

HS-022 639

**URBAN CONSORTIUM FOR TECHNOLOGY  
INITIATIVES, TRANSPORTATION TASK FORCE**

TRANSPORTATION FOR ELDERLY AND HAN-  
DICAPPED PERSONS

HS-022 554

NEW STANDARD BUS EQUIPMENT

HS-022 555

TRAFFIC SIGNALIZATION SYSTEMS

HS-022 556

**VOLKSWAGENWERK A.G.**

PASSIVE VEHICLE SAFETY AS CARS GROW  
SMALLER

HS-022 617

**VOLKSWAGENWERK A.G., RES. AND DEVEL.  
[GERMANY]**

A COMPARISON OF ADVANCED BELT SYSTEMS RE-  
GARDING THEIR EFFECTIVENESS

HS-022 623

**VOLKSWAGENWERK A.G., RES. AND DEVEL.,  
WOLFSBURG, GERMANY**

AERODYNAMIC IMPROVEMENTS--A GREAT POTEN-  
TIAL FOR BETTER FUEL ECONOMY

HS-022 615

VOLKSWAGEN'S PASSIVE SEAT BELT/KNEE  
BOLSTER RESTRAINT, VWRA--A PRELIMINARY  
FIELD PERFORMANCE EVALUATION--PROGRESS  
REPORT

HS-022 625

**VOLKSWAGENWERK A.G., WOLFSBURG,  
GERMANY**

ON THE RELATIONSHIP BETWEEN GROSS VEHICLE  
WEIGHT, PAYLOAD, EFFECTIVE RANGE, AND COST  
OF ELECTRIC VEHICLES

HS-022 611

**WABCO WESTINGHOUSE G.M.B.H., HANNOVER,  
GERMANY**

AIR BRAKING SYSTEMS WITH INCREASED PRES-  
SURE

HS-022 598

AIR BRAKING SYSTEMS FOR COMMERCIAL VEHI-  
CLES IN COMPLIANCE WITH THE EEC-DIRECTIVE  
71/320 BRAKING

HS-022 602

**WESTMINSTER HOSPITAL SURGICAL UNIT,  
ENGLAND**

THE EFFECT OF SURGICAL OPERATION ON THE  
'BRAKE-CLUTCH SIMULATOR'

HS-022 589

## Contract Number Index

### DOT-FH-11-9186

SCIENCE APPLICATIONS, INC., 1801 AVE. OF THE  
STARS, SUITE 1205, LOS ANGELES, CALIF. 90067  
HS-022 696

### DOT-HS-5-01215

MINICARS, INC., 35 LA PATERA LANE, GOLETA,  
CALIF. 93017  
HS-803 249

MINICARS, INC., 35 LA PATERA LANE, GOLETA,  
CALIF. 93017  
HS-803 250

MINICARS, INC., 35 LA PATERA LANE, GOLETA,  
CALIF. 93017; BUDD CO.; MAN FACTORS, INC.; MARC  
ANALYSIS RES. CORP.; MONSANTO RES. CORP.  
HS-803 251

MINICARS, INC., 35 LA PATERA LANE, GOLETA,  
CALIF. 93017; RCA LABS.; STANFORD RES. INST.;  
SYSTEMS TECHNOLOGY, INC.; UNIV. OF UTAH  
HS-803 252

### DOT-HS-5-01267

DUNLAP AND ASSOCIATES, INC., 1 PARKLAND  
DRIVE, DARIEN, CONN. 06820  
HS-803 274

### DOT-HS-6-01366

UNIVERSITY OF SOUTH DAKOTA, HUMAN FAC-  
TORS LAB., VERMILLION, S. DAK. 57069  
HS-803 285

### DOT-HS-6-01476

CHIEF MEDICAL EXAMINER-CORONER, HALL OF  
JUSTICE, LOS ANGELES, CALIF. 90012  
HS-803 287

### DOT-HS-6-01514

CALSPAN CORP., BUFFALO, N.Y. 14221  
HS-803 313  
CALSPAN CORP., BUFFALO, N.Y. 14221  
HS-803 318  
CALSPAN CORP., BUFFALO, N.Y. 14221  
HS-803 319  
CALSPAN CORP., BUFFALO, N.Y. 14221  
HS-803 320  
CALSPAN CORP., BUFFALO, N.Y. 14221  
HS-803 321

### DOT-TSC-1299

TRANSPORTATION SYSTEMS CENTER, KENDALL  
SQUARE, CAMBRIDGE, MASS. 02142; STATE OF  
MAINE DEPT. OF TRANSPORTATION, MATERIAL  
AND RES. DIV., BOX 1208, HOGAN RD., BANGOR,  
MAINE 04401  
HS-022 548

### DOT-TSC-589

UNIVERSITY OF LOWELL RES. FOUNDATION, 450  
AIKEN ST., LOWELL, MASS. 01854  
HS-022 692

### DOT-TSC-870

STORCH ENGINEERS, 824 BOYLSTON ST., CHEST-  
NUT HILL, MASS. 02167  
HS-022 691

### ENG-75-22768

UNIVERSITY OF MICHIGAN, HWY. SAFETY RES.  
INST., ANN ARBOR, MICH. 48109  
HS-022 701

### EPA-68-01-2111

INSTITUTE OF GAS TECHNOLOGY, CHICAGO, ILL.  
60616  
HS-022 643

INSTITUTE OF GAS TECHNOLOGY, CHICAGO, ILL.  
60616  
HS-022 644

### ERDA-E(11-1)-2690

THERMO ELECTRON CORP., 101 FIRST AVE.,  
WALTHAM, MASS. 02154  
HS-022 646

### FHWA-CA-09-0046

SOUTHERN CALIFORNIA ASSOC. OF GOVERN-  
MENTS, 600 S. COMMONWEALTH AVE., SUITE 1000,  
LOS ANGELES, CALIF. 90005  
HS-022 650

### TSP-110

UNIVERSITY OF MICHIGAN, HWY. SAFETY RES.  
INST., ANN ARBOR, MICH. 48109  
HS-022 704

# Report Number Index

DOT-TR-3147-1-77-01

2690-1

0/77

1/77

2/77

3/77

6/77

7/77

8/77

9/77

1/77

2/77

3/77

4/77

6/77

7/77

8/77

0/77

2/76

2/77

3/76

6/77

4/76

5/76

HS-022 525 C26/76

HS-022 646 C27/76

HS-022 528 C28/76

HS-022 529 C29/76

HS-022 530 C30/76

HS-022 531 C31/76

HS-022 532 C32/76

HS-022 533 C33/76

HS-022 534 C34/76

HS-022 535 C35/76

HS-022 536 C36/76

HS-022 537 C37/76

HS-022 538 C38/76

HS-022 539 C39/76

HS-022 541 C40/76

HS-022 542 C42/76

HS-022 543 C43/76

HS-022 544 C44/76

HS-022 567 C45/76

HS-022 545 C46/76

HS-022 570 C47/76

HS-022 546 C48/76

HS-022 571 C49/76

HS-022 574 C50/76

HS-022 569

HS-022 572

HS-022 573

HS-022 575

HS-022 576

HS-022 577

HS-022 578

HS-022 579

HS-022 580

HS-022 581

HS-022 582

HS-022 583

HS-022 584

HS-022 585

HS-022 586

HS-022 588

HS-022 589

HS-022 590

HS-022 591

HS-022 592

HS-022 593

HS-022 594

HS-022 568

HS-022 595



C51/76		NCHRP-179	HSL 78-08
C52/76	HS-022 596		HS-022 550
C71/76	HS-022 597	PB-271 570	
C72/76	HS-022 600	PR-10	HS-022 650
C76/76	HS-022 602	PR-11	HS-803 319
C78/76	HS-022 598	PR-12	HS-803 320
C79/76	HS-022 601	PR-8	HS-803 321
DOT-TSC-FRA-76-21,I	HS-022 599	PR-9	HS-803 313
DOT-TSC-FRA-76-21,II	HS-022 691	SAE-770233	HS-803 318
DOT-TSC-NHTSA-78-1	HS-022 692	SAE-770234	HS-022 552
DOT-TSC-OST-77-6	HS-803 223	SAE-770235	HS-022 678
DOT-TSC-OST-77-69	HS-022 548	SAE-770237	HS-022 687
ED 77-8	HS-022 642	SAE-780009	HS-022 700
EDP/C-01-(77)	HS-803 274	SAE-780022	HS-022 513
EPA-460/3-74-012-A	HS-022 645	SAE-780028	HS-022 514
EPA-460/3-74-012-B	HS-022 643	SAE-780030	HS-022 515
ERDA-77-54	HS-022 644	SAE-780032	HS-022 516
FHWA-RD-77-137	HS-022 647	SAE-780035	HS-022 517
FHWA-RD-77-139	HS-022 698	SAE-780053	HS-022 518
FHWA-RD-77-168	HS-022 696	SAE-780063	HS-022 519
FRA/ORD-77/45.I	HS-022 697	SAE-780074	HS-022 520
FRA/ORD-77/45.II	HS-022 691	SAE-780085	HS-022 521
HFL-78-1	HS-022 692	SAE-780090	HS-022 522
I-MECH-E-CONFERENCE-PUBLICATIONS-1976-5	HS-803 285	SAE-780130	HS-022 523
I-MECH-E-CONFERENCE-PUBLICATIONS-1977-6	HS-022 566	SAE-780131	HS-022 603
	HS-022 527	SAE-780132	HS-022 604
			HS-022 605

August 31, 1978

SAE-780168	HS-022 606	SAE-780414	HS-022 623
SAE-780169	HS-022 607	SAE-780434	HS-022 624
SAE-780195	HS-022 608	SAE-780436	HS-022 625
SAE-780196	HS-022 609	SAI-260-78-518	HS-022 696
SAE-780207	HS-022 558	SP-427	HS-022 557
SAE-780208	HS-022 559	T-1037	HS-803 312
SAE-780209	HS-022 560	TE4193-76-75	HS-022 646
SAE-780210	HS-022 561	TRR-629	HS-022 626
SAE-780211	HS-022 562	TRRL-LR-742	HS-022 673
SAE-780212	HS-022 563	TRRL-LR-761	HS-022 674
SAE-780213	HS-022 564	TRRL-LR-768	HS-022 675
SAE-780214	HS-022 565	TRRL-LR-775	HS-022 676
SAE-780219	HS-022 610	TRRL-SR-222	HS-022 677
SAE-780220	HS-022 611	TRRL-SR-263	HS-022 679
SAE-780258	HS-022 612	TRRL-SR-267	HS-022 680
SAE-780261	HS-022 613	TRRL-SR-271	HS-022 681
SAE-780263	HS-022 614	TRRL-SR-276	HS-022 682
SAE-780265	HS-022 615	TRRL-SR-277	HS-022 683
SAE-780280	HS-022 616	TRRL-SR-283	HS-022 684
SAE-780282	HS-022 617	TRRL-SR-286	HS-022 685
SAE-780283	HS-022 618	TRRL-SR-291	HS-022 686
SAE-780290	HS-022 619	TRRL-SR-294	HS-022 688
SAE-780351	HS-022 620	TRRL-SR-321	HS-022 689
SAE-780364	HS-022 621	UC-96	HS-022 647
SAE-780368	HS-022 622	UM-HSRI-77-55	HS-022 704

UM-HSRI-78-10

HS-022 701

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## **CONTRACTS AWARDED**

DOT-HS-5-01063 TASK ORDER 13 MOD. 1

#### **TIRE FAILURE ANALYSIS**

ALL SOURCE DOCUMENTS RECEIVED FROM THE ODI (OFFICE OF DEFECTS INVESTIGATION) SHALL BE ANALYZED, AND THE MILEAGE GIVEN AT THE TIME OF FAILURE FOR EACH TIRE SHALL BE ENTERED INTO THE DATA BASE FILE. ALL ADP (AUTOMATIC DATA PROCESSING) PROGRAMS SHALL BE MODIFIED TO INCLUDE A MILEAGE FIELD. ADDITIONAL PAGES OF SOURCE DOCUMENTS RECEIVED FROM ODI SHALL BE REPRODUCED.

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

\$10,618.00

TO BE COMPLETED BY 31 JUL 78

DOT-HS-6-01501 MOD. 6

#### **ADJUSTMENT OF NCHS [NATIONAL CENTER FOR HEALTH STATISTICS] DATA**

FOR SUBTASK 3.2 (ALLOCATION OF UNKNOWNNS IN TABLE 4-1), ALL STEPS OF SUBTASK 2.2 SHALL BE APPLIED IN THE PRODUCTION OF THE FOLLOWING BIVARIATE TABLES (CAUSE OF DEATH X PERSON INJURED) FOR EACH YEAR (1968-1974) OF NATIONAL CENTER FOR HEALTH STATISTICS (NCHS) MOTOR VEHICLE MORTALITY DATA: TOTAL UNADJUSTED DATA (ONE TABLE OF TOTAL UNADJUSTED TRAFFIC DATA, ONE TABLE OF TOTAL UNADJUSTED NON-TRAFFIC DATA); CATEGORICAL DATA, FOR EACH CATEGORY OF EACH VARIABLE, E.G. MALE/FEMALE FOR SEX (ONE TABLE OF UNADJUSTED TRAFFIC DATA, ONE TABLE OF ADJUSTED TRAFFIC DATA, ONE TABLE OF UNADJUSTED NONTRAFFIC DATA, ONE TABLE OF ADJUSTED NONTRAFFIC DATA); AND TOTAL ADJUSTED DATA, SUMMARY OVER ALL CATEGORIES FOR EACH VARIABLE (ONE TABLE OF TOTAL ADJUSTED TRAFFIC DATA, ONE TABLE OF TOTAL ADJUSTED NONTRAFFIC DATA).

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

INCREASED \$8,707.00

EXTENDED TO 31 JUL 78

DOT-HS-7-01754 MOD. 2

#### **SYSTEM OPTIMIZATION OF STATE ACCIDENT DATA BASES**

THE FOLLOWING ASSISTANCE SHALL BE PROVIDED FOR THE EIGHT STATES WHICH WERE HSP PILOT STATES AND WERE THE INITIAL RECIPIENTS OF THE DART SYSTEM (DELAWARE, IDAHO, SOUTH DAKOTA, OKLAHOMA, ARIZONA, NEW JERSEY, FLORIDA, AND NEBRASKA): INCORPORATE THE PROGRAMMING CHANGES IN DART THAT HAVE BEEN MADE SINCE THE INSTALLATIONS IN THE ORIGINAL STATES; PROVIDE ASSISTANCE IN CONVERTING THE 1977 CALENDAR YEAR FILE WHERE THAT FILE IS COMPLETE AND READY FOR CONVERSION; PROVIDE OTHER SPECIAL TECHNICAL ASSISTANCE (DIAGNOSE THE PROBLEMS IN DELAWARE'S DART SYSTEM, REVIEW THE DATA STRUCTURES OF THOSE ELEMENTS IN OKLAHOMA'S ACCIDENT FILE WHICH ARE CURRENTLY INHIBITING MEANINGFUL USE OF THOSE DATA IN STATISTICAL ANALYSES AND ASSIST IN DEVELOPING PROPER CONVERSION RULES FOR HANDLING THESE, AND ASSESS FLORIDA'S DESIGNATED COMPUTER SITE TO HOUSE DART); AND CONDUCT SPECIALIZED TRAINING SESSIONS IN THOSE STATES WHICH HAVE IDENTIFIED A NEED FOR ADDITIONAL INSTRUCTION (IDAHO, SOUTH DAKOTA, AND ARIZONA).

GENASYS CORPORATION, 11300 ROCKVILLE PIKE,  
ROCKVILLE, MARYLAND 20852  
INCREASED \$21,817.00  
NO CHANGE

DOT-HS-7-01775 MOD. 1

#### **NATIONAL ENERGY EFFICIENT DRIVING SYSTEM (NEEDS)**

BASED UPON THE ANALYSIS CONDUCTED DURING PHASE 1, A REVIEW OF EXISTING POTENTIALS FOR THE USE OF NEEDS (NATIONAL ENERGY EFFICIENT DRIVING SYSTEMS) PRODUCTS SHALL BE PERFORMED AND A WORK PLAN DEVELOPED. PARTICULAR ATTENTION SHOULD BE GIVEN TO MOTIVATIONAL/MARKETING STRATEGIES REQUIRED TO INITIATE THE NEEDS PROGRAM IN VARIOUS SETTINGS AND TO GET PEOPLE TO USE THE INFORMATION IN REACHING THE TRANSPORTATION REQUIREMENTS. CURRENT MATERIALS THAT SHOULD BE USED, MATERIALS THAT SHOULD BE MODIFIED, AND NEW MATERIALS THAT ARE REQUIRED FOR NEEDS SHALL BE SPECIFIED; AND COST ESTIMATES FOR THE DEVELOPMENT OF THESE MATERIALS SHALL BE INCLUDED.

NATIONAL PUBLIC SERVICE RESEARCH INSTITUTE,  
421 KING STREET, ALEXANDRIA, VIRGINIA 22314  
INCREASED \$14,971.76  
NO CHANGE

DOT-HS-6-01389 MOD. 3

HSL 78-08

DOT-HS-6-01388 MOD. 5

#### NATIONAL CRASH SEVERITY STUDY

IN THE CONTINUING INVESTIGATION OF POLICE-REPORTED TOWAWAY ACCIDENTS WHERE AT LEAST ONE VEHICLE WAS TOWED FROM THE SCENE, THE SAMPLING CRITERIA SHALL BE ADJUSTED TO ALLOW FOR AN OVERSAMPLING OF SIDE INTRUSION/FIRE COLLISIONS AND THE ADDITION OF LIGHT TRUCKS, VANS AND MULTIPURPOSE VEHICLES. THE FOLLOWING SPECIAL PROTOCOLS SHALL BE IMPLEMENTED: REVISED FMVSS 301 FUEL LEAKAGE/SPILLAGE/FIRE PROTOCOL, AND REVISED FMVSS 214 SIDE INTRUSION/PASSENGER COMPARTMENT INTRUSION PROTOCOL. THE FOLLOWING PROTOCOLS SHALL BE DELETED: SURGICAL PROCEDURES SPECIAL REPORT, OFF-ROAD OBJECT SPECIAL REPORT, AND SEAT PERFORMANCE SPECIAL REPORT. TWO FIELD REPRESENTATIVES AND A PRINCIPAL INVESTIGATOR SHALL ATTEND TRAINING SESSIONS (TWO DAYS EACH) IN THE APPLICATION OF THE FUEL LEAKAGE METHODOLOGY AND THE INTRUSION METHODOLOGY, AND TO ADDRESS ERRORS AND PROBLEM AREAS WITHIN THE NCSS (NATIONAL CRASH SEVERITY STUDY). ALL COLLISIONS SHALL BE RECONSTRUCTED USING THE CALSPAN RECONSTRUCTION OF ACCIDENT SPEEDS ON THE HIGHWAY (CRASH), WITH PARTICULAR EMPHASIS PLACED ON ACQUIRING DATA FOR INPUT INTO THE TRAJECTORY ROUTINE OF THE CRASH RECONSTRUCTION TO ESTIMATE IMPACT SPEEDS. 0EL

DYNAMIC SCIENCE, INC., 1850 WEST PINNACLE PEAK ROAD, PHOENIX, ARIZONA 85027  
INCREASED \$193,561.00  
EXTENDED THROUGH 16 JUL 79

DOT-HS-6-01389 MOD. 3

#### NATIONAL CRASH SEVERITY STUDY

IN THE CONTINUING INVESTIGATION OF POLICE-REPORTED TOWAWAY ACCIDENTS WHERE AT LEAST ONE VEHICLE WAS TOWED FROM THE SCENE, THE SAMPLING CRITERIA SHALL BE ADJUSTED TO ALLOW FOR AN OVERSAMPLING OF SIDE INTRUSION/FIRE COLLISIONS AND THE ADDITION OF LIGHT TRUCKS, VANS AND MULTIPURPOSE VEHICLES. THE FOLLOWING SPECIAL PROTOCOLS SHALL BE IMPLEMENTED: REVISED FMVSS 301 FUEL LEAKAGE/SPILLAGE/FIRE PROTOCOL, AND REVISED FMVSS 214 SIDE INTRUSION/PASSENGER COMPARTMENT INTRUSION PROTOCOL. THE FOLLOWING PROTOCOLS SHALL BE DELETED: SURGICAL PROCEDURES SPECIAL REPORT, OFF-ROAD OBJECT SPECIAL REPORT, AND SEAT PERFORMANCE SPECIAL REPORT. TWO FIELD REPRESENTATIVES AND A PRINCIPAL INVESTIGATOR SHALL ATTEND TRAINING SESSIONS (TWO DAYS EACH) IN THE APPLICATION OF THE FUEL LEAKAGE METHODOLOGY AND THE INTRUSION METHODOLOGY, AND TO ADDRESS ERRORS AND PROBLEM AREAS WITHIN THE NCSS (NATIONAL CRASH SEVERITY STUDY). ALL COLLISIONS SHALL BE RECONSTRUCTED USING THE CALSPAN RECONSTRUCTION OF ACCIDENT SPEEDS ON THE HIGHWAY (CRASH), WITH PARTICULAR EMPHA-

SIS PLACED ON ACQUIRING DATA FOR INPUT INTO THE TRAJECTORY ROUTINE OF THE CRASH RECONSTRUCTION TO ESTIMATE IMPACT SPEEDS. EST

UNIVERSITY OF MIAMI, CORAL GABLES, FLORIDA 33124  
INCREASED \$247,980.00  
EXTENDED THROUGH 16 JUL 79

DOT-HS-6-01390 MOD. 4

#### NATIONAL CRASH SEVERITY STUDY

IN THE CONTINUING INVESTIGATION OF POLICE-REPORTED TOWAWAY ACCIDENTS WHERE AT LEAST ONE VEHICLE WAS TOWED FROM THE SCENE, THE SAMPLING CRITERIA SHALL BE ADJUSTED TO ALLOW FOR AN OVERSAMPLING OF SIDE INTRUSION/FIRE COLLISIONS AND THE ADDITION OF LIGHT TRUCKS, VANS AND MULTIPURPOSE VEHICLES. THE FOLLOWING SPECIAL PROTOCOLS SHALL BE IMPLEMENTED: REVISED FMVSS 301 FUEL LEAKAGE/SPILLAGE/FIRE PROTOCOL, AND REVISED FMVSS 214 SIDE INTRUSION/PASSENGER COMPARTMENT INTRUSION PROTOCOL. THE FOLLOWING PROTOCOLS SHALL BE DELETED: SURGICAL PROCEDURES SPECIAL REPORT, OFF-ROAD OBJECT SPECIAL REPORT, AND SEAT PERFORMANCE SPECIAL REPORT. TWO FIELD REPRESENTATIVES AND A PRINCIPAL INVESTIGATOR SHALL ATTEND TRAINING SESSIONS (TWO DAYS EACH) IN THE APPLICATION OF THE FUEL LEAKAGE METHODOLOGY AND THE INTRUSION METHODOLOGY, AND TO ADDRESS ERRORS AND PROBLEM AREAS WITHIN THE NCSS (NATIONAL CRASH SEVERITY STUDY). ALL COLLISIONS SHALL BE RECONSTRUCTED USING THE CALSPAN RECONSTRUCTION OF ACCIDENT SPEEDS ON THE HIGHWAY (CRASH), WITH PARTICULAR EMPHASIS PLACED ON ACQUIRING DATA FOR INPUT INTO THE TRAJECTORY ROUTINE OF THE CRASH RECONSTRUCTION TO ESTIMATE IMPACT SPEEDS. 0EED

CALSPAN CORPORATION, POST OFFICE BOX 235, BUFFALO, NEW YORK 14221  
INCREASED \$237,700.00  
EXTENDED THROUGH 16 JUL 79

DOT-HS-6-01391 MOD. 5

#### NATIONAL CRASH SEVERITY STUDY

IN THE CONTINUING INVESTIGATION OF POLICE-REPORTED TOWAWAY ACCIDENTS WHERE AT LEAST ONE VEHICLE WAS TOWED FROM THE SCENE, THE SAMPLING CRITERIA SHALL BE ADJUSTED TO ALLOW FOR AN OVERSAMPLING OF SIDE INTRUSION/FIRE COLLISIONS AND THE ADDITION OF LIGHT TRUCKS, VANS AND MULTIPURPOSE VEHICLES. THE FOLLOWING SPECIAL PROTOCOLS SHALL BE IMPLEMENTED: REVISED FMVSS 301 FUEL LEAKAGE/SPILLAGE/FIRE PROTOCOL, AND REVISED FMVSS 214 SIDE INTRUSION/PASSENGER COMPARTMENT INTRUSION PROTOCOL. THE FOLLOWING PROTOCOLS SHALL BE DELETED: SURGICAL PROCEDURES SPECIAL REPORT, OFF-ROAD OBJECT

August 31, 1978

DOT-HS-7-01530 MOD. 4

SPECIAL REPORT, AND SEAT PERFORMANCE SPECIAL REPORT. TWO FIELD REPRESENTATIVES AND A PRINCIPAL INVESTIGATOR SHALL ATTEND TRAINING SESSIONS (TWO DAYS EACH) IN THE APPLICATION OF THE FUEL LEAKAGE METHODOLOGY AND THE INTRUSION METHODOLOGY, AND TO ADDRESS ERRORS AND PROBLEM AREAS WITHIN THE NCSS (NATIONAL CRASH SEVERITY STUDY). ALL COLLISIONS SHALL BE RECONSTRUCTED USING THE CALSPAN RECONSTRUCTION OF ACCIDENT SPEEDS ON THE HIGHWAY (CRASH), WITH PARTICULAR EMPHASIS PLACED ON ACQUIRING DATA FOR INPUT INTO THE TRAJECTORY ROUTINE OF THE CRASH RECONSTRUCTION TO ESTIMATE IMPACT SPEEDS. 0EL

SOUTHWEST RESEARCH INSTITUTE, 8500 CULEBRA ROAD, SAN ANTONIO, TEXAS 78284  
INCREASED \$392,565.00  
EXTENDED THROUGH 16 JUL 79

DOT-HS-6-01392 MOD. 4

#### NATIONAL CRASH SEVERITY STUDY

IN THE CONTINUING INVESTIGATION OF POLICE-REPORTED TOWAWAY ACCIDENTS WHERE AT LEAST ONE VEHICLE WAS TOWED FROM THE SCENE, THE SAMPLING CRITERIA SHALL BE ADJUSTED TO ALLOW FOR AN OVERSAMPLING OF SIDE INTRUSION/FIRE COLLISIONS AND THE ADDITION OF LIGHT TRUCKS, VANS AND MULTIPURPOSE VEHICLES. THE FOLLOWING SPECIAL PROTOCOLS SHALL BE IMPLEMENTED: REVISED FMVSS 301 FUEL LEAKAGE/SPILLAGE/FIRE PROTOCOL, AND REVISED FMVSS 214 SIDE INTRUSION/PASSENGER COMPARTMENT INTRUSION PROTOCOL. THE FOLLOWING PROTOCOLS SHALL BE DELETED: SURGICAL PROCEDURES SPECIAL REPORT, OFF-ROAD OBJECT SPECIAL REPORT, AND SEAT PERFORMANCE SPECIAL REPORT. TWO FIELD REPRESENTATIVES AND A PRINCIPAL INVESTIGATOR SHALL ATTEND TRAINING SESSIONS (TWO DAYS EACH) IN THE APPLICATION OF THE FUEL LEAKAGE METHODOLOGY AND THE INTRUSION METHODOLOGY, AND TO ADDRESS ERRORS AND PROBLEM AREAS WITHIN THE NCSS (NATIONAL CRASH SEVERITY STUDY). ALL COLLISIONS SHALL BE RECONSTRUCTED USING THE CALSPAN RECONSTRUCTION OF ACCIDENT SPEEDS ON THE HIGHWAY (CRASH), WITH PARTICULAR EMPHASIS PLACED ON ACQUIRING DATA FOR INPUT INTO THE TRAJECTORY ROUTINE OF THE CRASH RECONSTRUCTION TO ESTIMATE IMPACT SPEEDS. AL

INDIANA UNIVERSITY FOUNDATION, 355 N. LANSING STREET, INDIANAPOLIS, INDIANA 46202  
INCREASED \$309,568.00  
EXTENDED THROUGH 16 JUL 79

DOT-HS-6-01394 MOD. 4

#### NATIONAL CRASH SEVERITY STUDY

IN THE CONTINUING INVESTIGATION OF POLICE-REPORTED TOWAWAY ACCIDENTS WHERE AT LEAST ONE VEHICLE WAS TOWED FROM THE SCENE, THE

SAMPLING CRITERIA SHALL BE ADJUSTED TO ALLOW FOR AN OVERSAMPLING OF SIDE INTRUSION/FIRE COLLISIONS AND THE ADDITION OF LIGHT TRUCKS, VANS AND MULTIPURPOSE VEHICLES. THE FOLLOWING SPECIAL PROTOCOLS SHALL BE IMPLEMENTED: REVISED FMVSS 301 FUEL LEAKAGE/SPILLAGE/FIRE PROTOCOL, AND REVISED FMVSS 214 SIDE INTRUSION/PASSENGER COMPARTMENT INTRUSION PROTOCOL. THE FOLLOWING PROTOCOLS SHALL BE DELETED: SURGICAL PROCEDURES SPECIAL REPORT, OFF-ROAD OBJECT SPECIAL REPORT, AND SEAT PERFORMANCE SPECIAL REPORT. TWO FIELD REPRESENTATIVES AND A PRINCIPAL INVESTIGATOR SHALL ATTEND TRAINING SESSIONS (TWO DAYS EACH) IN THE APPLICATION OF THE FUEL LEAKAGE METHODOLOGY AND THE INTRUSION METHODOLOGY, AND TO ADDRESS ERRORS AND PROBLEM AREAS WITHIN THE NCSS (NATIONAL CRASH SEVERITY STUDY). ALL COLLISIONS SHALL BE RECONSTRUCTED USING THE CALSPAN RECONSTRUCTION OF ACCIDENT SPEEDS ON THE HIGHWAY (CRASH), WITH PARTICULAR EMPHASIS PLACED ON ACQUIRING DATA FOR INPUT INTO THE TRAJECTORY ROUTINE OF THE CRASH RECONSTRUCTION TO ESTIMATE IMPACT SPEEDS. 0 WO

UNIVERSITY OF KENTUCKY, RESEARCH FOUNDATION, EAST WING, KINKEAD HALL, LEXINGTON, KENTUCKY 40506  
INCREASED \$237,006.00  
EXTENDED THROUGH 16 JUL 79

DOT-HS-6-01394 MOD. 3

#### NATIONAL CRASH SEVERITY STUDY

IN ORDER TO DETERMINE IF PRESENT ANTI-THEFT DEVICES ARE SUFFICIENT TO DETER THE AMATEUR THIEF, THE MAGNITUDE OF THE INVOLVEMENT OF STOLEN VEHICLES IN ACCIDENTS SHALL BE STUDIED. TO

UNIVERSITY OF KENTUCKY, RESEARCH FOUNDATION, EAST WING, KINKEAD HALL, LEXINGTON, KENTUCKY 40506  
INCREASED \$6,112.00  
NO CHANGE

DOT-HS-7-01530 MOD. 4

#### DRUG RESEARCH METHODOLOGY

THE FOLLOWING WORK SHALL BE PERFORMED AS PART OF THE DRUG RESEARCH METHODOLOGY STUDY: PLAN AND IMPLEMENT THREE ADDITIONAL WORKSHOPS (ONE FOCUSING ON METHODOLOGICAL ISSUES ASSOCIATED WITH ASSESSMENT OF THE RISKS OF DRUGS IN THE HIGHWAY SAFETY CONTEXT TO IDENTIFY AND ASSESS WHAT ALTERNATIVES THERE ARE AVAILABLE FOR RISK IDENTIFICATION OTHER THAN CASE CONTROL EPIDEMIOLOGICAL STUDY, AND TO IDENTIFY CANDIDATE METHODS FOR USE OR FURTHER DEVELOPMENT; A SECOND TO EXAMINE THE "ALCOHOL MODEL" (ESTABLISHMENT OF A PRESUMPTIVE LEVEL OF ARREST) TO DETERMINE IF SUCH A CON-

DOT-HS-7-01554 MOD. 5

HSL 78-08

CEPTUAL FRAMEWORK IS APPROPRIATE FOR DRUG AND DRIVING RESEARCH AND DEVELOPMENT OF COUNTERMEASURES; AND A THIRD CONSTITUTING A REVIEW AND SYNTHESIS OF SUBJECTS COVERED IN EACH OF THE SIX PREVIOUS TOPIC-SPECIFIC WORKSHOPS). 0 AD

THE REGENTS OF THE UNIVERSITY OF MICHIGAN,  
260 RESEARCH ADMINISTRATION BUILDING, THE  
UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN  
48104

INCREASED \$78,790.00  
EXTENDED TO 30 JUN 79

DOT-HS-7-01554 MOD. 5

#### **EVALUATION OF THE FEASIBILITY OF A SINGLE BEAM HEADLIGHTING SYSTEM**

ADDITIONAL FIELD TESTS SHALL BE PERFORMED  
ON HEADLAMPS.STU

THE REGENTS OF THE UNIVERSITY OF MICHIGAN,  
260 RESEARCH ADMINISTRATION BUILDING, ANN  
ARBOR, MICHIGAN 48109

INCREASED \$24,816.00  
TO BE COMPLETED BY 31 JAN 79

DOT-HS-7-01725 MOD. 2

#### **TRUCK AND BUS SAFETY INSPECTION DEMONSTRATION PROJECT**

A MINIMUM OF 520 VEHICLES ACCORDING TO THE  
MIX ESTABLISHED IN TASK 2 SHALL BE INSPECTED

DISTRICT OF COLUMBIA, DEPARTMENT OF MOTOR  
VEHICLES, 301 C STREET, N.W., WASHINGTON, D.C.  
20590

INCREASED \$32,543.00  
TO BE COMPLETED BY 30 SEP 78

DOT-HS-7-01790 MOD. 1

#### **AUGMENTATION OF RESEARCH AND ANALYSIS CAPABILITIES FOR TIMELY SUPPORT OF AUTOMOTIVE FUEL ECONOMY ACTIVITIES**

THE FOLLOWING RESEARCH ON EXHAUST EMIS-  
SIONS SHALL BE PERFORMED: A REVIEW OF THE  
CURRENT STATE OF THE ART IN TECHNOLOGY FOR  
THE CONTROL OF UNREGULATED DIESEL EMIS-  
SIONS (COVERING BOTH PARTICULATES AND ODOR  
BUT EMPHASIZING THE CONTROL OF PARTICU-  
LATES); A REVIEW OF THE CURRENT STATE OF  
KNOWLEDGE REGARDING THE IMPACT OF DIESEL  
PARTICULATES ON HEALTH, AND REGARDING THE  
IMPACT OF THE PENETRATION OF LIGHT-DUTY  
VEHICLES ON ENVIRONMENTAL PARTICULATE  
MATTER AND ODOR (EMPHASIZING PARTICULATE  
MATTER). THESE RESEARCH EFFORTS WILL AID IN  
DETERMINING THE POTENTIAL IMPACT OF A RAPID

INCREASE IN SALES OF DIESEL VEHICLES IN THE  
1980'S.0ND

SOUTH COAST TECHNOLOGY, INC., POST OFFICE  
BOX 3265, SANTA BARBARA, CALIFORNIA 93106  
INCREASED \$74,449.00  
TO BE COMPLETED BY 2 OCT 78

DOT-HS-8-01809 MOD. 1

#### **SMALL CAR FRONT-SEAT PASSENGER INFLATABLE RESTRAINT SYSTEM**

INSTEAD OF DEVELOPING AND DEMONSTRATING  
THREE (3) PASSENGER AIR BAG SYSTEMS, TWO (2)  
PASSENGER AIR BAG SYSTEMS AND ONE (1) DRIVER  
SYSTEM SHALL BE DEVELOPED AND DEMON-  
STRATED AS HAVING THE CAPABILITY TO MEET  
FMVSS NO. 208 REQUIREMENTS IN PROTECTING  
BOTH THE DRIVERS AND PASSENGERS IN A  
SELECTED FRONT ENGINE-FRONT DRIVE SUBCOM-  
PACT CAR. IN ADDITION, A SELECTED FRONT EN-  
GINE-REAR DRIVE SUBCOMPACT CAR WILL BE  
TESTED AGAIN IN THIS PROGRAM ON A RIDE-ALONG  
BASIS IN SELECTED SLED TESTS AND IN FULL-  
SCALE CRASH TESTS TO SHOW CLEARLY IN THE  
TEST FILMS THAT FULL FRONT-SEAT PASSIVE PRO-  
TECTION IS POSSIBLE IN THIS VEHICLE.0 EF

MINICARS, INC., 35 LA PATERA LANE, GOLETA,  
CALIFORNIA 93017  
NO CHANGE  
NO CHANGE

DOT-HS-8-01906

#### **ENERGY EFFICIENT COMMERCIAL VEHICLE DRIVING**

AN ENERGY EFFICIENT COMMERCIAL VEHICLE  
DRIVER PROGRAM SHALL BE DESIGNED,  
DEVELOPED, AND TESTED IN ORDER TO STIMULATE  
ENERGY CONSERVATION.0 AS

CHILTON COMPANY, RADNOR, PENNSYLVANIA 19089  
\$262,079.00  
TO BE COMPLETED THIRTY-SIX (36) MONTHS FROM  
DATE OF CONTRACT AWARD (5 JUL 78)

DOT-HS-8-01947

#### **LOADING DOCKET FILE**

A DOCKET FILE SHALL BE ESTABLISHED UNDER  
THE RECON/STIMS INFORMATION RETRIEVAL  
SYSTEM. 0D T

INFORMATICS, INC., 7926 JONES BRANCH DRIVE,  
SUITE 272, MCLEAN, VA. 22101  
\$15,604.00  
TO BE COMPLETED SIXTY (60) DAYS FROM DATE OF  
CONTRACT AWARD (14 JUN 78)



August 31, 1978

DOT-HS-5-01060 TASK ORDER 17

DOT-HS-8-01949

**SAFETY RELATED DEFECTS (SRD)  
INVESTIGATION OF HEAVY DUTY COMMERCIAL  
VEHICLES, MOTORCOACH AND SCHOOL BUS,  
FMVSS NO. 121, AIR BRAKE ANTILOCK FAILSAFE  
TEST**

IN ORDER TO DETERMINE IF THE FMVSS NO. 121 ANTILOCK AIR BRAKE SYSTEM WILL FAILSAFE WHEN DELIBERATE FAILURE MODES ARE INDUCED, SIX (6) VEHICLES SHALL BE TESTED IN ACCORDANCE WITH FMVSS NO. 121, AIR BRAKE SYSTEMS (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) LABORATORY TEST PROCEDURE TP-121-01 DATED SEPTEMBER 20, 1976, WITH THE DELETION OF PARAGRAPHS 2.2.3 AND 2.2.24 RELATING TO THE PARKING BRAKE). A SPECIAL REQUIREMENT OF THE TESTING WILL BE THAT THE VEHICLE ELECTRICAL SYSTEM VOLTAGE AVAILABLE TO THE ANTILOCK SYSTEM SHALL BE A NORMAL 12 VOLTS PLUS OR MINUS 2 VOLTS, AND THAT THE VOLTAGE SHALL BE REDUCED AT THE RATE OF 2 VOLTS PER TEST DURING EACH FAILURE MODE TEST TO DETERMINE WHAT EFFECT, IF ANY, LOW VOLTAGE MAY HAVE ON THE ANTILOCK SYSTEM.

DYNAMIC SCIENCE, INC., 1850 WEST PINNACLE PEAK ROAD, PHOENIX, ARIZONA 85027  
\$60,110.00  
TO BE COMPLETED SIXTY (60) DAYS FROM DATE OF CONTRACT AWARD (30 JUN 78)

DOT-HS-8-01968

**ADVANCED ACCIDENT RECONSTRUCTION  
TRAINING FOR THE NATIONAL ACCIDENT  
SAMPLING SYSTEM**

A TRAINING PROGRAM IN ACCIDENT RECONSTRUCTION FOR MOTOR VEHICLE ACCIDENT INVESTIGATORS SHALL BE DEVELOPED AND IMPLEMENTED, THE AIMS OF WHICH ARE AS FOLLOWS: TO IMPROVE STUDENT ABILITY TO UNDERSTAND AND COMMAND THE PRINCIPLES, SKILLS, AND PRACTICES USED IN RECONSTRUCTION OF THE MORE COMPLICATED ACCIDENT TYPES; AND TO TRAIN STUDENTS TO RECONSTRUCT PRECISELY AND UNIFORMLY A WIDE VARIETY OF ACCIDENT TYPES, BASED ON THE PRACTICAL SKILLS AND THEORIES LEARNED IN THIS COURSE.

THE REGENTS OF THE UNIVERSITY OF MICHIGAN, 260 RESEARCH ADMINISTRATION BUILDING, THE UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN 48109  
\$62,085.00  
TO BE COMPLETED NINETEEN (19) MONTHS FROM DATE OF CONTRACT AWARD (2 JUN 78)

DOT-HS-8-01972IA

**ALCOHOL BEVERAGE ADVERTISING STUDY**

A LITERATURE REVIEW SHALL BE PERFORMED OF ALCOHOL BEVERAGE ADVERTISING AND ITS EF-

FFECT ON CONSUMER KNOWLEDGE, BELIEFS, AND ATTITUDES. THE OBJECTIVES OF THIS STUDY ARE AS FOLLOWS: TO DEVELOP A SET OF DIMENSIONS WHICH DESCRIBE THE MESSAGES CONVEYED BY SPECIFIC ALCOHOLIC BEVERAGE ADVERTISEMENTS; AND TO TEST THE DIMENSIONS CHOSEN, SO AS TO OBTAIN USEFUL PREDICTIONS OF THE EFFECT ON CONSUMER KNOWLEDGE OF AND ATTITUDES TOWARD ALCOHOL BEVERAGE ADVERTISEMENTS. CAL

DEPARTMENT OF TREASURY, BUREAU OF ALCOHOL TOBACCO & FIREARMS, BENJAMIN FRANKLIN STATION BLDG., 1200 PENNSYLVANIA AVENUE, N.W., WASHINGTON, D.C. 20026  
\$25,000.00  
TO BE COMPLETED TWELVE (12) MONTHS FROM DATE OF CONTRACT AWARD (20 JUN 78)

DOT-HS-8-01991

**DPMAS SOFTWARE MODIFICATION-PROGRAM  
CODING AND CHECKOUT**

A COMPUTER PROGRAM TO UNPACK AND REFORMAT DPMAS (DRIVER PERFORMANCE MEASUREMENT AND ANALYSIS SYSTEM) DIGITAL DATA TAPES SHALL BE WRITTEN, INSTALLED, CHECKED OUT, DOCUMENTED AND DEMONSTRATED; AND USER DOCUMENTATION, INCLUDING THE PREPARATION OF A USER'S MANUAL FOR OPERATING THIS PROGRAM, SHALL BE PROVIDED. OEVE

SOUTHERN CALIFORNIA RESEARCH INSTITUTE, 6305 ARIZONA PLACE, LOS ANGELES, CALIFORNIA 90045  
\$45,647.00  
TO BE COMPLETED EIGHT (8) MONTHS FROM DATE OF CONTRACT AWARD (20 JUL 78)

**FATAL ACCIDENT FILE, OR  
DATA CONVERSION**

THE FOLLOWING WORK SHALL BE PERFORMED FOR THE FATAL ACCIDENT FILE WITH RESPECT TO SOURCE DOCUMENT DATA ON A SELECTED VEHICLE RECALL CAMPAIGN: RECEIVE DOCUMENTS AND LOG IN; DEVELOP SPECIFICATIONS FOR CODING AND COMPUTER PROGRAM; CODE REQUIRED DATA FROM EACH DOCUMENT; KEY AND KEY VERIFY CODED INFORMATION; DESIGN PROGRAM TO CREATE DATA BASE AND COMPUTER LISTINGS; DELIVER DOCUMENTS, COMPUTER LISTING AND MAGNETIC TAPE TO NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) WITH CODED DATA SHEETS RETURNED IN SEQUENTIAL ORDER; AND CHECK FILE FOR DUPLICATES, WHICH SHALL BE DELETED FROM THE MAGNETIC TAPE BUT WILL BE LISTED.

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF

TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC  
SAFETY ADMINISTRATION."

\$3,100.00

TO BE COMPLETED BY 4 AUG 78

DOT-HS-6-01287 MOD. 5

#### **ELECTROMAGNETIC INTERFERENCE/COMPATIBILITY RESEARCH**

ADDITIONAL ELECTROMAGNETIC INTERFERENCE TESTS SHALL BE PERFORMED ON TRACTOR AND TRAILER BRAKES WITH ANTILOCK SYSTEMS (FMVSS NO. 121); RESULTS SHALL BE COMPARED TO THOSE ACQUIRED IN TASK A IN ORDER TO DETERMINE THE VALIDITY OF TEM CELL TEST PROCEDURES. THE FIRST OF TWO SERIES OF TESTS SHALL BE PERFORMED AT THE WHITE SANDS MISSILE TEST RANGE (WSMTR). THESE TESTS SHALL BE CONDUCTED AT AUTHORIZED TEST FREQUENCIES WITH SOURCE FIELDS FURNISHED BY THE WSMTR FACILITY. THE VEHICLE WILL HAVE A ZERO VELOCITY, AND THE ANTILOCK BRAKE SYSTEM FAILURE WARNING INDICATOR WILL BE USED AS A CRITERION FOR DETERMINING BRAKE SYSTEM CONDITION. ALSO, A METHODOLOGY SHALL BE DEVELOPED AND VALIDATED AT WSMTR FOR SIMULATING NORMAL WHEEL ROTATION OF THE TRACTOR AND TRAILER. CONTINGENT UPON FREQUENCY CLEARANCES, ON-BOARD MOBILE TRANSMITTERS SHALL BE PROVIDED FOR USE AS ADDITIONAL FIELD SOURCES. THE SECOND SERIES OF TESTS SHALL BE PERFORMED AT THE VEHICLE RESEARCH AND TEST CENTER (VRTC), EAST LIBERTY, OHIO. THE TESTS SHALL BE PERFORMED AT A MINIMUM OF EIGHT (8) FREQUENCIES. THE ELECTROMAGNETIC FIELD SOURCES SHALL BE ON-BOARD MOBILE TRANSMITTERS. ANTENNAS AND GROUND PLANES SHALL BE ARRANGED TO PRODUCE WORST-CASE CONDITIONS, AS WELL AS NORMAL OPERATING CONDITIONS. THE VEHICLES SHALL BE DRIVEN AT VELOCITIES SUFFICIENT TO ACTIVATE THE 121 BRAKE SYSTEMS IN THE AUTOMATIC MODE. A DRIVER, FURNISHED BY NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION), SHALL EVALUATE THE EFFECTIVENESS OF THE ANTILOCK BRAKE SYSTEMS UNDER ALL TEST CONDITIONS. 0 WA

DEPARTMENT OF COMMERCE, NATIONAL BUREAU  
OF STANDARDS, 325 BROADWAY, BOULDER,  
COLORADO 80302  
INCREASED \$31,000.00  
EXTENDED TO 31 DEC 78

DOT-HS-6-01442 MOD. 4

#### **NATIONAL CRASH SEVERITY STUDY--QUALITY CONTROL**

THE QUALITY CONTROL ACTIVITIES FOR THE NATIONAL CRASH SEVERITY STUDY (NCSS) SHALL BE EXTENDED FOR 12 MONTHS TO ACCOMMODATE FOR ADDITIONAL DATA COLLECTION. SPECIFICALLY, THE FOLLOWING WORK SHALL BE ACCOMPLISHED:

PREPARE AND EXECUTE A PLAN OF WORK INCLUDING FIELD VISITS TO DATA COLLECTION SITES AND REVIEW OF CODED FIELD DATA REPORTS TO VERIFY THEIR COMPLETE AND PROPER EXECUTION (ADDITION TO TASK 1); SCHEDULE TWO ON-SITE VISITS TO EACH DATA COLLECTION TEAM (ADDITION TO TASK 2); PERFORM MAJOR VARIABLE CHECKS ON 100% OF THE CASES SUBMITTED BY THE DATA COLLECTION TEAMS (ADDITION TO TASK 3); IMPLEMENT TWO SPECIAL PROTOCOLS (REVISED FMVSS 301 FUEL LEAKAGE/SPILLAGE/FIRE PROTOCOL, AND REVISED FMVSS 214 SIDE INTRUSION/PASSENGER COMPARTMENT INTRUSION PROTOCOL), PREPARE FIELD FORMS FROM DRAFT FIELD FORMS SUPPLIED BY NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) FOR INCLUSION OF LIGHT TRUCKS, VANS AND MULTIPURPOSE VEHICLES INTO THE NCSS, DELETE CERTAIN SPECIAL PROTOCOLS (SURGICAL PROCEDURES, OFF-ROAD OBJECT AND SEAT PERFORMANCE SPECIAL REPORTS), SEND TWO REPRESENTATIVES EACH TO THE TRAINING SESSIONS IN WHICH THE FIELD DATA COLLECTION TEAMS WILL BE INSTRUCTED IN THE NECESSARY TECHNIQUES FOR IMPLEMENTING FUEL LEAKAGE/SPILLAGE AND INTRUSION PROTOCOLS, AND DEVELOP VALIDATION AND CONSISTENCY CHECKS FOR THE CODED DATA (ADDITION OF TASK 9); AND PROVIDE STORAGE FACILITIES FOR ALL CASES SUBMITTED DURING THE ENTIRE CONTRACT (ADDITION OF TASK 10).

CALSPAN CORPORATION, 4455 GENESEE STREET,  
ERIE COUNTY, BUFFALO, NEW YORK 14221  
INCREASED \$171,202.00  
TO BE COMPLETED BY 20 AUG 79

DOT-HS-6-01479 MOD. 3

#### **MATERIAL APPLICATIONS IN FUTURE AUTOMOTIVE STRUCTURES**

THE FOLLOWING ADDITIONAL TASKS SHALL BE PERFORMED IN THE STUDY OF MATERIAL APPLICATIONS IN FUTURE AUTOMOTIVE STRUCTURES: REVIEW TASKS 2, 3, AND 4, COMPLETED ORIGINALLY FOR THE PASSENGER AUTOMOBILE DESIGN EFFORT, AND UPDATE TO INCLUDE MATERIALS WHICH COULD BE AVAILABLE IN THE 1985-1990 TIME FRAME FOR LIGHT-DUTY TRUCKS (LDT); SELECT A PASSENGER VAN ACCORDING TO CERTAIN CRITERIA (LARGER WHEELBASE/GVWR/PASSENGER CAPACITY VERSION WHOSE GVWR IS LESS THAN 8,500 LBS., UNIBODY CONSTRUCTION, CONSIDERATION OF MOST POPULAR ENGINE SIZE AND DRIVELINE CONFIGURATION, AND A HIGH (1978 PRODUCTION MODEL); DETERMINE THE SECTION PROPERTIES AND OVERALL DESIGN REQUIREMENTS FOR THE VEHICLE USING AVAILABLE LITERATURE, ENGINEERING DRAWINGS AND AN ACTUAL VEHICLE; DEVELOP ALTERNATE DESIGN CONCEPTS OF THE MAJOR COMPONENTS USING CANDIDATE MATERIALS, CONSIDERING THE LONG-TERM WEIGHT REDUCTION POTENTIAL BEYOND MODEL YEAR 1985 AND UP TO MODEL YEAR 1990 (USING THE CRITERIA (IN ORDER OF PRIORITY) OF WEIGHT REDUCTION POTENTIAL, MANUFACTURING PRODU-

August 31, 1978

DOT-HS-7-01732IA AMEND. 2

CABILITY, LIFETIME ENERGY REDUCTION, LEAD-TIME AND INVESTMENT COST, LIFETIME CONSUMER COST REDUCTION, CRASHWORTHINESS/DURABILITY, AND DISPOSABILITY); DETERMINE AND COMPARE WITH THE ORIGINAL COMPONENT THE WEIGHT OF EACH COMPONENT DESIGN AND INTEGRATE THE REDESIGNED COMPONENTS INTO THE TOTAL VEHICLE BASED ON THE VEHICLE'S NEW LOWER WEIGHT, AND REDESIGN THE WEIGHT-DEPENDENT COMPONENTS (I.E. SPRINGS, ETC.) TO ACCOUNT FOR THE SMALLER LOAD THEY NEED TO SUPPORT; AND DOCUMENT DESIGN CONCEPTS BY QUANTIFYING CRITERIA CITED ABOVE FOR THE DEVELOPMENT OF ALTERNATE DESIGN CONCEPTS. 01NA

THE BUDD COMPANY, 300 COMMERCE DRIVE, FORT WASHINGTON, PENNSYLVANIA 19037  
INCREASED \$137,000.00  
EXTENDED THROUGH 30 JAN 79

DOT-HS-7-01477 MOD. 11

#### TESTING OF PASSENGER VEHICLE FOR COMPLIANCE TESTING

ON-BOARD CAMERA COVERAGE (TWO (2) CAMERAS/VEHICLE) SHALL BE OBTAINED FOR THIRTEEN (13) SELECTED 1978 PASSENGER VEHICLE MODELS (VANS AND LIGHT TRUCKS) FOR COMPLIANCE TESTING.

APPROVED ENGINEERING TEST LABS., 1536 EAST VALENCIA DRIVE, POST OFFICE BOX 4158, FULLERTON, CALIFORNIA 92631  
\$23,725.00  
NO CHANGE

DOT-HS-7-01549 MOD. 4

#### LORAN DEMONSTRATION LABORATORY

THE FOLLOWING TECHNICAL SUPPORT SHALL BE PROVIDED FOR THE LORAN C DEMONSTRATION LABORATORY (LDL) SYSTEM: UPGRADE THE SYSTEM SOFTWARE AND EVALUATE, ACQUIRE, AND IMPLEMENT HARDWARE COMPONENTS NECESSARY TO PROVIDE THE LDL WITH THE FLEXIBLE CAPABILITY TO CONDUCT STATE/LOCAL ON-SITE DEMONSTRATIONS AT SITES SELECTED BY POTENTIAL USER AGENCIES; AND CONDUCT THE ON-SITE DEMONSTRATIONS AND MAINTAIN EQUIPMENT. 0ASE

THE MITRE CORPORATION, METREK DIVISION, 1820 DOLLY MADISON BLVD., MCLEAN, VIRGINIA 22101  
INCREASED \$34,959.00  
EXTENDED TO 30 SEP 79

DOT-HS-7-01670 MOD. 1

#### COMPLIANCE TESTING OF SCHOOL BUSES

SEAT ASSEMBLIES OF SCHOOL BUSES SHALL BE TESTED IN SUPPORT OF AN INDICATED NONCOMPLIANCE WITH FMVSS NO. 222 WITH REGARD TO THE

AREA OF CONTACT DURING IMPACT TESTING WITH HEAD AND KNEE FORMS. ALL IMPACT TESTS ARE TO BE CONDUCTED INSIDE THE BUS ACCORDING TO NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) LABORATORY TEST PROCEDURE TP-222-00 DATED MARCH 3, 1977. THE TESTS SHALL CONSIST OF THE FOLLOWING TYPES: FOUR PAIRS OF HEAD FORM IMPACTS AT 5 FT/SEC ON THREE SELECTED SEAT ASSEMBLIES FOR COMPARISON OF THE AREA OF CONTACTS THAT ARE MADE WHEN FIVE DIFFERENT TRANSFER MEDIA ARE USED, FOUR PAIRS OF KNEE FORM IMPACTS AT 16 FT/SEC ON A SECOND ASSEMBLY OF ONE OF THE SELECTED SEAT ASSEMBLIES, AND FOUR ADDITIONAL HEAD FORM IMPACTS AT 5 FT/SEC ON ONE OF THE SELECTED SEAT ASSEMBLIES AT FOUR LOCATIONS THAT WERE PREVIOUSLY IMPACTED TO DETERMINE THE EFFECT ON THE CONTACT AREA WHEN IMPACTS ARE MADE AT THE SAME SPOT USING EACH OF THE FIVE DIFFERENT TRANSFER MEDIA.

MOBILITY SYSTEMS AND EQUIPMENT COMPANY, 6151 WEST CENTURY BOULEVARD, LOS ANGELES, CALIFORNIA 90045  
\$5,300.00  
NO CHANGE

DOT-HS-7-01680 MOD. 1

#### HYDRAULIC BRAKE SYSTEMS

HYDRAULIC BRAKE SYSTEMS SHALL BE TESTED IN ACCORDANCE WITH FMVSS NO. 105-75 (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) LABORATORY TEST PROCEDURE TP-105-75-03 DATED JULY 7, 1978, SECTIONS 1 THROUGH 10, 12, 13, 15 AND 16). 0COR

NORTH AMERICAN TESTING COMPANY, 1801 SPEEDWAY BOULEVARD, POST OFFICE DRAWER S, DAYTONA BEACH, FLORIDA 32015  
NO CHANGE  
EXTENDED TO 10 AUG 79

DOT-HS-7-01732IA AMEND. 2

#### COMPUTERIZATION OF HEAD AND NECK INJURY INFORMATION

THE COMPUTER PROGRAM FOR DESCRIBING INJURIES TO THE HEAD AND NECK SHALL BE FURTHER DEVELOPED TO PERMIT EACH PARTICIPATING HOSPITAL TRAUMA CENTER TO PROVIDE DATA FOR A COMMON POOL AND TO ENABLE RESEARCHERS TO PERFORM STATISTICAL STUDIES ON THE RESULTING ENLARGED DATA SET. THE FOLLOWING TASKS SHALL BE ACCOMPLISHED: DEVELOP A FORTRAN COMPUTER PROGRAM WHICH COULD BE USED ON SMALL COMPUTERS SUCH AS THE PDPII; DEVELOP OR OBTAIN DIAGRAMS AND FIGURES OF THE HEAD AND NECK WHICH CLEARLY OUTLINE THE REGIONS DEFINED BY THE ANATOMICAL LOCATORS AND PROVIDE SKETCHES DEPICTING THE CT SCANNING PLANES AND ANATOMICAL LOCATOR REGIONS, SO THAT RADIOLOGISTS CAN RECORD CT SCAN INFORMATION USING INJURY RECORD LOCA-

TORS; DEVELOP A CENTRAL DATA COLLECTION PROCEDURE FOR THE ESTABLISHMENT OF A HEAD AND NECK INJURY DATA BANK AND INVESTIGATE STATISTICAL PACKAGES WHICH COULD BE USED TO ANALYZE RESULTS; CONTINUE COORDINATING THE DATA GATHERING EFFORT WITH MEMBERS OF THE HEAD AND NECK INJURY COMMITTEE AND OTHERS INTERESTED IN PROVIDING INJURY DATA; PROCESS, BY CONVERTING TO DIGITAL FORM, 100 INJURY RECORDS FROM THE DOT (DEPARTMENT OF TRANSPORTATION) MOTORCYCLE ACCIDENT STUDY IN LOS ANGELES COUNTY; AND COMPARE CT SCAN DATA WITH AUTOPSY RESULTS.

NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIFORNIA 93043  
INCREASED \$65,000.00  
EXTENDED TO 26 JUN 79

DOT-HS-7-01790 MOD. 2

#### **AUGMENTATION OF RESEARCH AND ANALYSIS CAPABILITIES FOR TIMELY SUPPORT OF AUTOMOTIVE FUEL ECONOMY ACTIVITIES**

THE CURRENT STATE OF THE ART OF THE MEASUREMENT AND CHARACTERIZATION OF DIESEL UNREGULATED EMISSIONS SHALL BE REVIEWED, AND A DISCUSSION SHALL BE PRESENTED ON THE PROGRESS NEEDED IN THESE AREAS TO ADEQUATELY ESTIMATE THE IMPACT OF UNREGULATED DIESEL EMISSION IN THE 1980'S IF THE SALE OF DIESEL VEHICLES INCREASES RAPIDLY. THE EMPHASIS WILL BE ON THE MEASUREMENT/CHARACTERIZATION OF PARTICULATE MATTER AND ODOR.

SOUTH COAST TECHNOLOGY, INC., POST OFFICE BOX 3265, SANTA BARBARA, CALIFORNIA 93106  
INCREASED \$24,915.00  
TO BE COMPLETED IN NINETY (90) DAYS

DOT-HS-8-01953 MOD. 1

#### **SURVEY OF PRIVATE CITIZENS TO OBTAIN INFORMATION ON PASSIVE RESTRAINT SYSTEMS**

THE CONDUCT OF THE SURVEY (TASK 4) SHALL BE MODIFIED. THE SELECTION OF HOUSEHOLDS SHALL BE MADE IN THE FOLLOWING MANNER: ESTIMATE THE NUMBER OF HOUSING UNITS ON THE BLOCK OR OTHER AREA ASSIGNED FOR INTERVIEWS, AND DIVIDE THAT NUMBER BY THE TOTAL NUMBER OF INTERVIEWS TO BE CONDUCTED AT THAT SAMPLING LOCATION, YIELDING AN INTERVAL NUMBER; CONDUCT AN INTERVIEW AT THE HOUSING UNIT DESIGNATED ON THE BLOCK OR OTHER AREA AS THE STARTING POINT; FROM THAT STARTING POINT, REGARDLESS OF WHETHER INTERVIEW COMPLETED, SKIP THE NUMBER OF HOUSING UNITS EQUAL TO THE INTERVAL NUMBER AND AT THAT LOCATION, MAKE A SECOND ATTEMPT TO CONDUCT AN INTERVIEW; AND PROCEED AROUND THE BLOCK USING THE PRESCRIBED INTERVAL NUMBER. THE INTERVIEWER WILL BE REQUIRED TO CALL BACK

ON THE INTERVIEWING DAY AT HOUSEHOLDS WHERE NO ONE WAS AT HOME INITIALLY. ON SUBSEQUENT INTERVIEWING DAYS, INTERVIEWERS WILL BE REQUIRED TO BEGIN INTERVIEWING AT A SECOND DESIGNATED STARTING POINT. SEX AND AGE QUOTAS WILL NOT BE ASSIGNED. IN ORDER TO INSURE A LARGE NUMBER OF RESPONDENTS WHO ARE POTENTIAL NEW-CAR BUYERS, THE SAMPLE SIZE HAS BEEN INCREASED FROM 1,500 TO 2,000 COMPLETED INTERVIEWS. 0 DA

PETER D. HART RESEARCH ASSOCIATES, 1529 O STREET, N.W., WASHINGTON, D.C. 20005  
INCREASED \$21,358.00  
EXTENDED TO 24 JUL 78

DOT-HS-6-01474IA MOD. 3

#### **DOT-BUREAU OF CENSUS NATIONAL TRAVEL SURVEY**

A NUMBER OF STATISTICAL TABULATIONS SHALL BE PRODUCED FROM THE 1977 NATIONAL PERSONAL TRANSPORTATION SURVEY (NPTS-1977) DATA TAPES COMPILED BY THE BUREAU OF THE CENSUS FOR THE DEPARTMENT OF TRANSPORTATION (DOT). THESE TABULATIONS WILL GENERALLY CONSIST OF UNIVARIATE AND BIVARIATE FREQUENCY DISTRIBUTIONS WITH ACCOMPANYING PERCENTAGE FIGURES AND WILL BE UTILIZED TO SUPPORT THE FEDERAL RESEARCH AND DEVELOPMENT PROGRAM IN HIGHWAY SAFETY AS SPECIFIED ORIGINALLY.

FEDERAL HIGHWAY ADMINISTRATION, OFFICE OF HIGHWAY PLANNING HHP-1, 400 7TH STREET, SW, WASHINGTON, D.C. 20590  
INCREASED \$80,000.00  
EXTENDED TO 30 JUN 79

DOT-HS-7-01808

#### **AN URBAN PEDESTRIAN SAFETY DEMONSTRATION PROJECT**

AN URBAN PEDESTRIAN SAFETY DEMONSTRATION PROJECT SHALL BE CONDUCTED. 0 NA

DADE COUNTY DEPARTMENT OF TRAFFIC AND TRANSPORTATION, 8675 N.W. 53RD STREET, SUITE 201, MIAMI, FLORIDA 33166  
\$950,000.00  
TO BE COMPLETED BY 30 SEP 1982

DOT-HS-6-01512 MOD. 4

#### **MULTIDISCIPLINARY HIGHWAY COLLISION INVESTIGATION TRAINING COURSE**

TWO COURSES FOR THE TRAINING OF ACCIDENT INVESTIGATION AND ALLIED SPECIALISTS, USING THE MULTIDISCIPLINARY HIGHWAY COLLISION INVESTIGATION TRAINING COURSE CURRICULUM, SHALL BE ARRANGED, CONDUCTED, AND REPORTED

August 31, 1978

ON. APPROXIMATELY 30 STUDENTS WILL BE TRAINED IN EACH OF THE TWO COURSES. OREQ

DYNAMIC SCIENCE, INC., 1850 WEST PINNACLE PEAK ROAD, PHOENIX, ARIZONA 85027  
INCREASED \$49,520.00  
TO BE COMPLETED BY 31 JUL 79

DOT-HS-7-01590 MOD. 2

### EXPERIMENTAL STUDY OF HIGHWAY AERODYNAMICS

THE FOLLOWING TWELVE (12) TESTS SHALL BE PERFORMED UNDER TASK 2 (TESTING): THREE TESTS WITH A NARROW BRIDGE WALL AND THREE LATERAL SEPARATIONS, THREE TESTS WITH A WIDE BRIDGE WALL AND THREE LATERAL SEPARATIONS, THREE TESTS WITH A NARROW BRIDGE CROSS WINDS AND THREE LATERAL SEPARATIONS, AND THREE TESTS WITH OPPOSITE PASSING OF PASSENGER CAR AND TRUCK (THREE SEPARATIONS).

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, RESEARCH DIVISION, BLACKSBURG, VIRGINIA 24061  
INCREASED \$4,726.00  
EXTENDED THROUGH 31 AUG 78

DOT-HS-7-01657 MOD. 2

### IMPACT RESISTANCE OF NON-FERROUS PASSENGER CAR WHEELS

THE FOLLOWING WORK AND SERVICES SHALL BE PERFORMED IN THE IMPACT RESISTANCE STUDY OF NON-FERROUS PASSENGER CAR WHEELS: REDUCE MINIMUM IMPACT MASS TO 600 LB AND PROVIDE A SEPARATE 200-LB MASS FOR REPLACEMENT OF THE EXISTING 800-LB MASS; FABRICATE TWO 10-LB WEIGHT INCREMENTS TO ADD TO CHOICES OF IMPACT LOADS; FABRICATE SAFETY CAGE OF SUITABLE EXPANDED METAL AND STEEL FRAMING (CAGE TO HAVE SWINGING GATE(S) TO FACILITATE ACCESS TO MACHINE BY TEST PERSONNEL AND BE DETACHABLE FOR SHIPMENT AS A MACHINE ACCESSORY); FABRICATE AND INSTALL STEEL BAR GUIDES ON TEST MACHINE SO AS TO LIMIT LATERAL MOVEMENT OF DROPPING MASS DURING TEST AND IMPROVE CONTROL OF STRIKING POSITION; PURCHASE 8 WHEELS (4 EACH 13X5.5 ALUMINUM ALLOY, RATED 1080 LB; 2 EACH 14X6.75 ALUMINUM ALLOY, RATED 1570 LB; AND 2 EACH 15X7 ALUMINUM ALLOY, RATED 1570 LB); AND PERFORM TWO (2) IMPACT TESTS USING 13X5.5 WHEELS, AT 750-LB IMPACT MASS, 230 MM DROP HEIGHT. THE IMPACTED WHEELS SHALL BE PHOTOGRAPHED AFTER THE TESTS TO DOCUMENT THE RESULTS, AND THE MODIFIED MACHINE SHALL BE PHOTOGRAPHED.  
ESP

EG AND G AUTOMOTIVE RESEARCH, INC., 5404 BANDERA ROAD, SAN ANTONIO, TEXAS 78238  
INCREASED \$6,091.00  
EXTENDED TO 31 AUG 78

DOT-HS-8-01945

DOT-HS-7-01708 MOD. 4

### SUPPORT FOR ANALYTICAL TOOLS FOR AUTOMOTIVE FUEL ECONOMY ACTIVITIES

SUPPORT FOR TASKS 3 TO 5 REQUIRED FOR AUTOMOTIVE FUEL ECONOMY ACTIVITIES OF THE TECHNOLOGY ASSESSMENT DIVISION AND THE OFFICE OF FUEL ECONOMY SHALL BE PROVIDED AS FOLLOWS: TASK 3, DOCUMENTATION AND TRAINING (DOCUMENTATION OF THE STANDARDIZED AUTOMOBILE CHARACTERISTICS DATA BASE (ACDB), AND OF THE 1978 EPA (ENVIRONMENTAL PROTECTION AGENCY) DATA BASE WHICH HAS ALREADY BEEN UPDATED, AND CREATION OF MAGNETIC TAPE TO BACK UP EACH DATA BASE); TASK 4, PROGRAMMING SUPPORT (CONTINUED INPUT DATA ENTRY AND OPERATION OF NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) OF (OFFICE OF FUEL ECONOMY) COMPUTER PROGRAMS, DEVELOPMENT OF SMALL FORTRAN AND SYSTEM 1022 PROGRAMS, TABULATION AND COORDINATION OF COMPUTER PROGRAM OUTPUT); AND TASK 5, ANALYTICAL SUPPORT (FUEL ECONOMY NORMALIZATION, EPA DATA ACQUISITION SUPPORT, CONSUMER PREFERENCE PROJECTIONS, FUEL ECONOMY TECHNOLOGY ASSESSMENT LINEAR PROGRAMMING SUPPORT).

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."  
INCREASED \$74,221.00  
EXTENDED TO 31 DEC 78

DOT-HS-7-01750 MOD. 1

### ACCELERATOR CONTROL SYSTEMS

ACCELERATOR CONTROL SYSTEMS SHALL BE TESTED IN ACCORDANCE WITH FMVSS NO. 124 (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) LABORATORY TEST PROCEDURE TP-124-03 DATED MARCH 13, 1978); TESTING FACILITIES SHALL INCLUDE TEST CHAMBER CAPABLE OF BEING UTILIZED FOR RUNNING TESTS AS SPECIFIED IN TP-124-03

DAYTON T. BROWN, INC., CHURCH STREET, BOHEMIA, LONG ISLAND, NEW YORK 11716  
NO CHANGE  
NO CHANGE

DOT-HS-8-01945

### COMPLIANCE TESTING OF PASSENGER CARS IN ACCORDANCE WITH FMVSS NO. 111, "REARVIEW MIRRORS"

PASSENGER CARS SHALL BE TESTED IN ACCORDANCE WITH FMVSS NO. 111, REARVIEW MIRRORS (NATIONAL HIGHWAY TRAFFIC SAFETY AD-

DOT-HS-8-01997

HSL 78-08

MINISTRATION OF THE NATIONAL CRASH SEVERITY STUDY  
ENFORCEMENT AND LABORATORY TEST  
PROCEDURE (FEDERAL REGISTER, 42(17), 1977).

"THIS CONTRACT IS AWARDED BY THE SMALL  
BUSINESS ADMINISTRATION UNDER THE  
AUTHORITY OF SECTION 8(A) OF THE SMALL  
BUSINESS ACT (USC 637A), AND WILL BE  
ADMINISTERED BY THE DEPARTMENT OF  
TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC  
SAFETY ADMINISTRATION."  
PER DELIVERY ORDER  
TO BE COMPLETED ON 1 SEP 78 FROM DATE OF  
CONTRACT AWARD LETTER.

DOT-HS-8-01998

REPORTING POSSIBLE SAFETY DEFECT  
PROBLEMS AND CONDUCTING SPECIAL SAFETY-  
RELATED SURVEYS

A DIAGNOSTIC TRAFFIC INFORMATION SERVICE RE-  
GARDING POSSIBLE VEHICLE SAFETY DEFECTS AND  
SAFETY DEFECT INVESTIGATIONS IN PROGRESS  
SHALL BE PROVIDED. THIS SAFETY DEFECT-RE-  
LATED SERVICE WILL BE CONDUCTED, UPON  
REQUEST, FOR A PERIOD OF 12 MONTHS.

CALIFORNIA STATE ASSOCIATION OF ASSOCIATED  
VAN NEESE ASSOCIATION, SAN FRANCISCO, CA 94101  
\$25,000.00  
TO BE COMPLETED ON 1 SEP 78 FROM  
DATE OF CONTRACT AWARD LETTER.

DOT-HS-8-01999

TRAFFIC SAFETY AND CRASH SEVERITY  
INFORMATION

DATA COMPILED FROM THE NATIONAL CRASH  
MODIFICATION RECORD (NCRM) AND THE NATIONAL  
CRASH REPORTING SYSTEM (NCRS) SHALL BE  
ANALYZED AND EVALUATED FOR TRENDS AND  
SHALL BE AVAILABLE TO THE PUBLIC FOR  
USE IN THE DEVELOPMENT OF SAFETY  
STATISTICS. THE DATA SHALL BE  
EVALUATED FOR TRENDS AND SHALL BE  
ICATED TO THE PUBLIC FOR USE IN THE  
TO DATA ANALYSIS AND EVALUATION OF  
REPORTS SHALL BE AVAILABLE TO THE  
WILL BE AVAILABLE TO THE PUBLIC FOR  
HIGHWAY SAFETY AND CRASH SEVERITY  
ANALYSIS.

"THIS CONTRACT IS AWARDED BY THE SMALL  
BUSINESS ADMINISTRATION UNDER THE  
AUTHORITY OF SECTION 8(A) OF THE SMALL  
BUSINESS ACT (USC 637A), AND WILL BE  
ADMINISTERED BY THE DEPARTMENT OF  
TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC  
SAFETY ADMINISTRATION."  
\$25,990.00  
TO BE COMPLETED ON 1 SEP 78 FROM  
DATE OF CONTRACT AWARD LETTER.

DOT-HS-8-01997

CODING OF ADDITIONAL NCSS (NATIONAL  
CRASH SEVERITY STUDY) VARIABLES

THE FOLLOWING WORK SHALL BE PERFORMED FOR  
THE NATIONAL CRASH SEVERITY STUDY (NCSS):  
INDEX THE FILED FORMS FOR EACH NCSS CASE  
INVESTIGATED PRIOR TO APRIL 1, 1978; EXTRACT  
SPECIFIED INFORMATION FROM EACH CASE;  
RECORD THIS EXTRACTED INFORMATION ON A COD-  
ING FORM; AND TRANSCRIBE THE INFORMATION ON  
THE CODING FORMS ONTO A CARD-IMAGE COM-  
PUTER TAPE.

"THIS CONTRACT IS AWARDED BY THE SMALL  
BUSINESS ADMINISTRATION UNDER THE  
AUTHORITY OF SECTION 8(A) OF THE SMALL  
BUSINESS ACT (USC 637A), AND WILL BE  
ADMINISTERED BY THE DEPARTMENT OF  
TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC  
SAFETY ADMINISTRATION."  
\$54,930.00  
TO BE COMPLETED BY 1 SEP 78

DOT-HS-8-01999

METHODS FOR ESTIMATING EXPECTED BLOOD  
ALCOHOL CONCENTRATION

THE RELEVANT LITERATURE SHALL BE SEARCHED  
AND EXPERIMENTS SHALL BE CONDUCTED, IF  
NECESSARY, IN ORDER TO PROVIDE INFORMATION  
THAT CAN BE USED BY AN INDIVIDUAL TO ESTI-  
MATE HIS/HER EXPECTED BAC (BLOOD ALCOHOL  
CONCENTRATION) UNDER DIFFERENT CONDITIONS  
OF ALCOHOL INTAKE AND FOOD CONSUMPTION.  
THE LITERATURE SHALL ALSO BE USED AND EX-  
PERIMENTS SHALL BE CONDUCTED, IF NECESSARY,  
TO PROVIDE A TECHNICAL AND SCIENTIFIC REPORT  
ON THE IMPORTANT FACTORS, IN ADDITION TO AL-  
COHOL INTAKE, THAT INFLUENCE RESULTING BAC.  
SPECIALLY, THE LITERATURE RELEVANT TO THE EF-  
FECT OF FOOD INTAKE ON THE BAC SHALL BE SUR-  
VEYED.

RESEARCH, CALIFORNIA RESEARCH INSTITUTE, 6305  
BRADLEY PLACE, LOS ANGELES, CA 90045  
\$10,000.00  
TO BE COMPLETED TWELVE (12) MONTHS FROM  
DATE OF CONTRACT AWARD (21 AUG 78)

DOT-HS-8-01997 MOD. 7

TRAFFIC SAFETY VALIDATION

THE FOLLOWING ADDITIONAL TREADWEAR TESTS  
SHALL BE CONDUCTED USING TIRES FROM THE  
GROUP D TEST TIRE GROUPS: CONVOY TESTS (ONE SET  
OF GROUP A POLYESTER-STEEL RADIAL TIRES TO  
WEAR BARS IN NEVADA (TWO TIRES FROM NEVADA  
CONVOY TEST AND TWO FROM CON-  
VENTION CONVOY TEST, 25,000-30,000 ADDITIONAL  
MILES), ONE SET OF GROUP D BIAS TIRES TO BE  
USED TO WEAR BARS IN NEVADA (TWO TIRES FROM  
NEVADA AND TWO FROM TEXAS CONVOY TESTS, AP-

August 31, 1978

DOT-HS-7-01770 MOD. 2

PROXIMATELY 25,000 ADDITIONAL MILES), ONE PAIR OF GROUP E BIAS BELTED TIRES (FROM NEVADA CONVOY TEST), AND ONE PAIR OF GROUP F BIAS BELTED TIRES (FROM TEXAS CONVOY TEST), APPROXIMATELY 25,000 ADDITIONAL MILES); ACCELERATED TREADWEAR EXPERIMENTS (WITH GROUP A TIRES MOUNTED, DFMV-2 TO BE DRIVEN OVER THE NEVADA TREADWEAR COURSE IN CONVOY WITH AT LEAST TWO OTHER CARS; AND TWO GROUP A AND TWO GROUP D TIRES FROM THE NEVADA CONVOY TEST TO BE SUBMITTED TO AN ACCELERATED WEAR TEST SEQUENCE BEFORE AND AFTER THEY HAVE BEEN PUT THROUGH ADDITIONAL NEVADA CONVOY TESTING).

HODGES TRANSPORTATION, INC., NEVADA  
AUTOMOTIVE TEST CENTER, P.O. BOX 234, CARSON  
CITY, NEVADA 89701  
NO CHANGE  
EXTENDED THROUGH 30 OCT 78

DOT-HS-7-01577 MOD. 4

#### **TRAINING PROGRAM FOR THE NATIONAL ACCIDENT SAMPLING SYSTEM**

TASKS 8 AND 9 FROM THE ORIGINAL WORK STATEMENT CALLING FOR EXPANSION TRAINING FOR THE NASS (NATIONAL ACCIDENT SAMPLING SYSTEM) TEAMS IN SEPTEMBER 1978 AND JUNE 1979 SHALL BE DELETED AND REPLACED WITH THE FOLLOWING TASKS: UTILIZING THE BACKGROUND AND EXPERIENCE GAINED FROM THE INITIAL TRAINING CYCLE, DEVELOP A REPLACEMENT TRAINING CYCLE TO BE EXECUTED DURING NOVEMBER-DECEMBER 1978 (TASK 8); AND AFTER THE DETAILED CURRICULUM HAS BEEN APPROVED, PREPARE FOR AND CONDUCT THE TRAINING ON THE AGREED UPON DATES (TASK 9). 0AIR

ALLEN CORPORATION OF AMERICA, 517 SOUTH  
WASHINGTON STREET, ALEXANDRIA, VIRGINIA 22314  
INCREASED \$29,990.00  
NO CHANGE

DOT-HS-7-01590 MOD. 2

#### **EXPERIMENTAL STUDY OF HIGHWAY AERODYNAMICS**

IN THE EXPERIMENTAL STUDY OF HIGHWAY AERODYNAMICS, THE FOLLOWING ADDITIONAL TWELVE (12) TESTS SHALL BE PERFORMED: THREE TESTS WITH A NARROW BRIDGE WALL AND THREE LATERAL SEPARATIONS, THREE TESTS WITH A WIDE BRIDGE WALL AND THREE LATERAL SEPARATIONS, THREE TESTS WITH A NARROW BRIDGE CROSS WINDS AND THREE LATERAL SEPARATIONS, AND THREE TESTS WITH OPPOSITE PASSING OF PAS-

SENGER CAR AND TRUCK (THREE SEPARATIONS). 0  
BE

VIRGINIA POLYTECHNIC INSTITUTE AND STATE  
UNIVERSITY, RESEARCH DIVISION, BLACKSBURG,  
VIRGINIA 24061  
INCREASED \$4,726.00  
EXTENDED THROUGH 31 AUG 78

DOT-HS-7-01657 MOD. 2

#### **IMPACT RESISTANCE OF NON-FERROUS PASSENGER CAR WHEELS**

IN THE IMPACT RESISTANCE TESTING OF NON-FERROUS PASSENGER CAR WHEELS, THE FOLLOWING WORK AND SERVICES SHALL BE PERFORMED: REDUCE MINIMUM IMPACT MASS TO 600 LB AND PROVIDE A SEPARATE 200-LB MASS FOR REPLACEMENT OF THE EXISTING 800-LB MASS, FABRICATE TWO 10-LB WEIGHT INCREMENTS TO ADD TO CHOICES OF IMPACT LOADS, AND FABRICATE SAFETY CAGE OF SUITABLE EXPANDED METAL AND STEEL FRAMING (CAGE TO HAVE SWINGING GATE(S) TO FACILITATE ACCESS TO MACHINE BY TEST PERSONNEL AND TO BE DETACHABLE FOR SHIPMENT AS A MACHINE ACCESSORY).

EG AND G AUTOMOTIVE RESEARCH, INC., 5404  
BANDERA ROAD, SAN ANTONIO, TEXAS 78238  
INCREASED \$6,091.00  
EXTENDED TO 31 AUG 78

DOT-HS-7-01681 MOD. 1

#### **HYDRAULIC BRAKE SYSTEMS**

HYDRAULIC BRAKE SYSTEMS SHALL BE TESTED IN ACCORDANCE WITH FMVSS NO. 105-75 (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) LABORATORY TEST PROCEDURE TP-105-75-03 DATED JULY 7, 1978, SECTIONS 1 THROUGH 10, 12, 13, 15, AND 16).

DYNAMIC SCIENCE, INC., 1850 WEST PINNACLE PEAK  
ROAD, PHOENIX, ARIZONA 85027  
NO CHANGE  
EXTENDED TO 10 AUG 79

DOT-HS-7-01770 MOD. 2

#### **DEVELOPMENT OF MOTOR VEHICLES HIGH VOLUME INDUSTRY**

BY UTILIZING DATA GENERATED IN THE BASE CONTRACT AND PERFORMING ADDITIONAL ANALYSES, A REPORT SHALL BE PREPARED WHICH ESTIMATES THE AVERAGE AND RANGE OF CONSUMER COSTS, POUND WEIGHT CHANGES, LIFETIME FUEL OPERATING COST, AND LEADTIME IMPACT IF PASSENGER CAR FMVSS 201 REQUIREMENTS WERE EXTENDED

OFFICE BOX 427, BLOOMFIELD HILLS, MICHIGAN  
INCREASED \$18,753.00  
EXTENDED TO 30 SEP 78

DOT-HS-8-01995

**IDENTIFY APPROACHES FOR THE CONTROL OF PROBLEMS ASSOCIATED WITH AIR BAG DISPOSAL**

BY REVIEWING AND UTILIZING INFORMATION/LITERATURE, THE PROBABLE HAZARDS RELATED TO THE DISPOSAL OF AIR BAG RESTRAINT SYSTEMS (HYBRID INFLATOR SYSTEM AND SOLID PROPELLANT INFLATOR SYSTEM) SHALL BE IDENTIFIED, AS WELL AS POSSIBLE SOLUTIONS AND POTENTIAL ALTERNATIVES TO THOSE PROBLEMS RESULTING FROM AIR BAG DISPOSAL.

ARTHUR D. LITTLE, INC., ACORN PARK, CAMBRIDGE, MASSACHUSETTS 02140  
\$50,406.00  
TO BE COMPLETED SEVENTY-FIVE (75) DAYS FROM DATE OF CONTRACT AWARD (16 AUG 78).

DOT-HS-8-02012

**COORDINATION OF NASS PUBLIC MEETING**

A NASS (NATIONAL ACCIDENT SAMPLING SYSTEM) PUBLIC MEETING TO REVIEW NASS PROGRESS AND MAKE RECOMMENDATIONS FOR THE NEXT TWO YEARS SHALL BE COORDINATED. 0 (H

MANAGEMENT ENGINEERS INCORPORATED, 11800 SUNRISE VALLEY DRIVE, RESTON, VIRGINIA 22091  
\$11,674.00  
TO BE COMPLETED FOUR (4) MONTHS FROM DATE OF CONTRACT AWARD (5 SEP 78).

DOT-HS-6-01442 MOD. 5

**NATIONAL CRASH SEVERITY STUDY--QUALITY CONTROL**

TASK 5.1 SHALL BE CHANGED TO READ AS FOLLOWS: ... A WORKING ALGORITHM THAT CALCULATES DELTA V'S AND IMPACT SPEEDS IN SINGLE OR TWO-CAR ACCIDENTS IN WHICH SLIP ANGLES OF EACH VEHICLE PRIOR TO IMPACT ARE CONSIDERED. ADEQUATE MODIFICATION OF THE QUIZ SUBROUTINE SHALL BE MADE TO ALLOW FOR INPUT OF SLIP ANGLES, E.G. ENTER THESE VALUES UNDER QUESTION 10, 'IMPACT POSITIONS'. TASK 5.8 SHALL BE DELETED. 00NN

CALSPAN CORPORATION, 4455 GENESEE STREET, ERIE COUNTY, BUFFALO, NEW YORK 14221  
INCREASED \$13,450.00  
TO BE COMPLETED THREE (3) MONTHS FROM DATE OF CONTRACT MODIFICATION (28 AUG 78).

ALL NECESSARY TRAINING MATERIALS FOR MODULES 1 (RANGE), 2 (OBSTACLE AVOIDANCE), AND 3 (INTERSECTING VEHICLES) SHALL BE PREPARED (TASK 5). THESE MATERIALS, AT A MINIMUM, SHALL INCLUDE THE FOLLOWING ITEMS: CLASSROOM INSTRUCTION, FIELD INSTRUCTION, INSTRUCTOR PROCEDURES, PERFORMANCE CRITERIA, MEASUREMENT PROCEDURES, TEACHING AIDS, INSTRUCTION SCHEDULES, AND STUDENT FEEDBACK REQUIREMENTS. THE THREE MODULES SHALL THEN BE ADMINISTERED TO 15 EXPERIENCED AND 30 NOVICE LICENSED DRIVERS; AND THE ENTRY LEVEL SKILLS OF THE SUBJECTS SHALL BE DETERMINED, AS WELL AS THEIR LEARNING RATES AND THEIR SKILL LEVELS AT THE END OF TRAINING ON THE THREE MODULES. CLASSROOM SIMULATOR TECHNOLOGY STATE OF THE ART SHALL BE REVIEWED, AND THE CAPABILITY OF PRESENT SIMULATORS TO FULFILL ACCIDENT AVOIDANCE SKILL TRAINING REQUIREMENTS SHALL BE ASSESSED (TASK 6). TASK 7 IS DELETED IN ITS ENTIRETY. THE 45 DRIVERS TRAINED IN TASK 5 SHALL BE RETESTED THREE MONTHS AFTER INITIAL TRAINING IN ORDER TO MEASURE THE AMOUNT OF SKILL RETENTION (TASK 8). TASK 8A IS ADDED AND REQUIRES THE USE OF THE RETENTION RESULTS OF TASK 8 TO PREPARE AND SUBMIT A RESEARCH PLAN FOR INVESTIGATING ADDITIONAL TRAINING WHICH MIGHT ENHANCE THE RETENTION OF DESIRABLE SKILLS. TASKS 9 THROUGH 12 ARE DELETED IN THEIR ENTIRETY. THE SKILLS STUDENTS SHOULD HAVE TO SUCCESSFULLY COMPLETE AND APPLY THE PROGRAM SHALL BE IDENTIFIED (TASK 13). TASK 14 IS DELETED IN ITS ENTIRETY.

ESSEX CORPORATION, 201 NORTH FAIRFAX STREET, ALEXANDRIA, VIRGINIA 22302  
INCREASED \$50,678.00  
EXTENDED TO 24 JAN 79

DOT-HS-7-01651 IA MOD. 1

**PHARMACOKINETIC EFFECTS OF DRUGS ON DRIVING PERFORMANCE**

THREE ADDITIONAL DRUGS (A TOTAL OF TEN DRUGS) SHALL BE TESTED TO DETERMINE THEIR EFFECTS ON DRIVING PERFORMANCE. ALSO, ALCOHOL/DRUG INTERACTION DATA SHALL BE OBTAINED FOR AT LEAST FOUR OF THE TEN DRUGS. TESTING OF EACH DRUG SHALL BE PERFORMED ON A DRIVING SIMULATOR DEVELOPED AT SOUTHERN CALIFORNIA RESEARCH INSTITUTE (SCRI).STU

NATIONAL INSTITUTE ON DRUG ABUSE, 11400 ROCKVILLE PIKE, ROCKVILLE, MD. 20852  
INCREASED \$466,000.00  
EXTENDED TO 30 JUN 81



A COST EVALUATION SHALL BE MADE OF BOTH FRONT AND REAR BUMPER SYSTEMS OF 17 ADDITIONAL SELECTED VEHICLE MODELS (COST EVALUATION OF FMVSS NO. 215). SUBASSEMBLIES AND SUBASSEMBLY COMPONENTS BY WEIGHT, MATERIAL TYPES, PROCESSING METHODS, HIGH-VOLUME INDUSTRIAL FIXED AND VARIABLE COST AND OTHER CONSUMER COSTS PER VEHICLE AND PER POUND OF VEHICLE SHALL BE IDENTIFIED FOR EACH BUMPER SYSTEM. ALL DATA MUST BE BASED ON MODEL YEAR ECONOMIC RATES AND U.S. PROCESSING METHODS. 0UBJ

THE JOHN Z. DELOREAN CORPORATION, POST OFFICE BOX 427, BLOOMFIELD HILLS, MICHIGAN 48013

INCREASED \$47,251.00  
EXTENDED TO 31 DEC 78

DOT-HS-8-01930

#### **MODEL STATE TRAFFIC RECORDS SYSTEM DEMONSTRATION PROJECT**

A TRAFFIC RECORDS SYSTEM THAT WILL BE PATTERNED AFTER THE CONCEPTUAL MODEL(S) SET FORTH IN THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S (NHTSA) "DESIGN MANUAL FOR STATE TRAFFIC RECORD SYSTEMS" SHALL BE DESIGNED AND IMPLEMENTED. THE OBJECTIVES OF THE PROJECT ARE TO DEMONSTRATE THE BENEFITS FOR SAFETY PROGRAM MANAGEMENT TO BE DERIVED FROM A TRAFFIC RECORDS SYSTEM THAT EMPLOYS ADVANCED DATA BASE MANAGEMENT TECHNIQUES AND IS FUNCTIONALLY INTEGRATED, TO PROVIDE DETAILED DOCUMENTATION FOR OTHER JURISDICTIONS IN DEVELOPING SIMILAR SYSTEMS, AND TO DEMONSTRATE THE FEASIBILITY (TECHNOLOGICALLY, PROCEDURALLY, AND COST-WISE) OF CONVERTING FROM AN ESTABLISHED SYSTEM TO THE MODEL ADVOCATED BY NHTSA IN THE DESIGN MANUAL. TA

STATE OF ALABAMA, DEPARTMENT OF FINANCE, DIVISION OF DATA SYSTEMS MANAGEMENT, 858 SOUTH COURT STREET, MONTGOMERY, ALABAMA 36130

\$1,141,350.00  
TO BE COMPLETED FOUR (4) YEARS FROM DATE OF CONTRACT AWARD (23 AUG 78).

DOT-HS-8-01970

#### **DEVELOPMENT AND FIELD TEST OF PSYCHOPHYSICAL TESTS FOR DWI ARREST**

LABORATORY DEVELOPMENT AND VALIDATION SHALL BE COMPLETED FOR THE SOBRIETY TEST BATTERY IDENTIFIED IN A PREVIOUS NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) STUDY (CONTRACT DOT-HS-5-01242), AND

COHOL CONCENTRATION) LEVELS GREATER THAN 0.10% STOPPED FOR SUSPICION OF DWI (DRIVING WHILE INTOXICATED), SHALL BE ASSESSED IN THE FIELD. 0 DO

SOUTHERN CALIFORNIA RESEARCH INSTITUTE, 6305 ARIZONA PLACE, LOS ANGELES, CA 90045

\$162,158.00

TO BE COMPLETED TWENTY (20) MONTHS FROM DATE OF CONTRACT AWARD (9 AUG 78).

DOT-HS-8-01984

#### **COMFORT AND CONVENIENCE OF SAFETY BELTS IN 1979 MODEL CARS**

COMFORT AND CONVENIENCE INDICES SHALL BE DETERMINED FOR AND USED TO RANK SAFETY BELT SYSTEMS IN NEW CARS SOLD IN THE UNITED STATES (1979 MODEL YEAR), AND THE "BEST" AND "WORST" BELT RESTRAINTS IN TERMS OF COMFORT AND CONVENIENCE SHALL BE IDENTIFIED.

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

\$88,486.00

TO BE COMPLETED THREE (3) MONTHS FROM DATE OF CONTRACT AWARD (7 AUG 78).

DOT-HS-8-01992

#### **NHTSA FACT BOOK MAINTENANCE**

STATISTICAL DATA AND INFORMATION SHALL BE OBTAINED FROM THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) IN ORDER TO UPDATE THE EXISTING NHTSA FACT BOOK; THE CONTENTS OF THE FACT BOOK SHALL BE EXPANDED AND ANALYZED TO INCLUDE ADDITIONAL ITEMS OF INTEREST TO THE HIGHWAY SAFETY COMMUNITY, AND THE FACT BOOK DATA BASE MAINTENANCE SYSTEM SHALL BE ENHANCED.

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

\$79,880.00

TO BE COMPLETED TWELVE (12) MONTHS FROM DATE OF CONTRACT AWARD (3 AUG 78).

DOT-HS-8-02000

**EFFECTS OF FUTURE CONDITIONS UPON MOTOR VEHICLE SAFETY REQUIREMENTS AND CRITERIA**

TO ASSURE THAT MOTOR VEHICLE SAFETY REQUIREMENTS AND CRITERIA WILL BE AS APPLICABLE AND EFFECTIVE UNDER NEW FIELD CONDITIONS DURING THE FUTURE PERIODS WHILE THEY ARE IN EFFECT, AS WAS INTENDED WHEN THEY WERE PROMULGATED, THE FOLLOWING WORK SHALL BE ACCOMPLISHED: DEFINE THE TYPES OF CHANGES IN FUTURE MOTOR VEHICLE TRANSPORTATION AND THE SAFETY PROBLEM TO WHICH THE APPLICABILITY AND EFFECTIVENESS OF SAFETY STANDARDS WOULD BE MOST SENSITIVE; DEVELOP A METHOD OF FORECASTING SUCH CHANGES AND OF DEFINING CORRESPONDING ADJUSTMENTS IN NEEDED SAFETY REQUIREMENTS AND CRITERIA; AND ESTABLISH THE INDICATORS AND THEIR SOURCES, AND PROVIDE MATHEMATICAL MODELS BY WHICH NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) COULD PERFORM THIS PROCESS IN THE FUTURE.

CENTER FOR THE ENVIRONMENT AND MAN, 275 WINDSOR STREET, HARTFORD, CONNECTICUT 06120  
\$84,686.00

TO BE COMPLETED BY 31 MAY 79.

DOT-HS-8-02002

**DWI ARREST PROCEDURES**

DWI (DRIVING WHILE INTOXICATED) POST-DETECTION ARREST PROCEDURES SHALL BE ANALYZED IN ORDER TO ACCOMPLISH THE FOLLOWING OBJECTIVES: DOCUMENT AND DESCRIBE THE CURRENT DWI POST-DETECTION ARREST PROCEDURES; IDENTIFY THE NEGATIVE FACTORS FOR DWI ARREST (I.E. CRITICAL ELEMENTS); ESTIMATE THE DEGREE TO WHICH EACH NEGATIVE FACTOR CAN BE MODIFIED (I.E. ASSESS THE CONSTRAINTS FOR CHANGE SUCH AS MANPOWER, BUDGETARY, AND EQUIPMENT LIMITATIONS); MAKE RECOMMENDATIONS FOR MORE EFFECTIVE DWI ARREST PROCEDURES WHICH OVERCOME THE NEGATIVE FACTORS; AND PROVIDE A POLICE TRAFFIC DWI ENFORCEMENT MANUAL DESCRIBING CURRENT DWI ARREST PROCEDURES, TOGETHER WITH PRELIMINARY ESTIMATES OF THEIR EFFECTIVENESS (I.E. WHAT SEEMS TO WORK AND WHAT SEEMS NOT TO WORK WITHIN A GIVEN SET OF LEGAL REQUIREMENTS).

ANACAPA SCIENCES, INC., P.O. DRAWER Q, SANTA BARBARA, CALIFORNIA 93102  
\$99,694.00

DOT-HS-8-02010

**SPECIAL TRAINING IN INJURY CODING**

A TRAINING PACKAGE SHALL BE PROVIDED, PREFERABLY IN THE FORMAT OF A CORRESPONDENCE COURSE, TO SUPPLEMENT THE BASIC TRAINING AND ONGOING FIELD EXPERIENCE OF NASS

(NATIONAL ACCIDENT SAMPLING SYSTEM) INVESTIGATORS, TO INCLUDE UNIFORM APPLICATION OF THE OIC (OCCUPANT INJURY CLASSIFICATION)/AIS (ABBREVIATED INJURY SCALE) CODES. THE PURPOSE OF THE TRAINING PACKAGE IS TO IMPROVE THE CONSISTENCY AND ACCURACY OF THE OIC/AIS CODING PROVIDED BY THE NASS INVESTIGATORS.

INDIANA UNIVERSITY FOUNDATION, INSTITUTE FOR RESEARCH IN PUBLIC SAFETY, 355 NORTH LANSING STREET, INDIANAPOLIS, INDIANA 46202  
\$39,526.00

TO BE COMPLETED NINE (9) MONTHS FROM DATE OF CONTRACT AWARD (5 SEP 78).

DOT-HS-8-02013

**DISTRIBUTION OF NHTSA PASSIVE RESTRAINT BROCHURES**

MULTI-STATE DISTRIBUTION AND MAINTENANCE OF 2.4 MILLION NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) PASSIVE RESTRAINT BROCHURES TO THE GENERAL PUBLIC THROUGH THE USE OF SUPERMARKET COMMUNICATION SYSTEMS, INC. (SCS) CONSUMER INFORMATION CENTERS LOCATED IN 4,000 MAJOR SUPERMARKETS AND DISCOUNT STORES, SHALL BE ACCOMPLISHED.0 IN

SUPERMARKET COMMUNICATION SYSTEMS, INC., YACHT HAVEN EAST, STAMFORD, CONNECTICUT 06902  
\$96,000.00  
6 SEP 78 TO 6 MAR 79

DOT-HS-8-02019

**DESIGN OF FIELD PASSIVE RESTRAINT EVALUATION**

AN EVALUATION PROGRAM USING ALTERNATIVE SAMPLING DESIGNS TO ASSESS THE FATALITY-REDUCING EFFECTIVENESS OF AIR BAGS AND/OR THE USAGE RATE AND FATALITY-REDUCING EFFECTIVENESS OF PASSIVE BELTS SHALL BE DEVELOPED. THE PROGRAM THAT IS DEVELOPED WILL BE CARRIED OUT BEGINNING IN CALENDAR YEAR 1979 PRIOR TO THE MANDATORY INSTALLATION OF PASSIVE RESTRAINTS IN ALL PASSENGER CARS.

THE CENTER FOR THE ENVIRONMENT AND MAN, INC., 275 WINDSOR STREET, HARTFORD, CONNECTICUT 06120  
\$61,999.00  
TO BE COMPLETED SIX (6) MONTHS FROM DATE OF CONTRACT AWARD (13 SEP 78).

## RESEARCH REQUIREMENTS

THROUGH A REVIEW OF PAST RESEARCH AND AN ANALYSIS OF CURRENT AS WELL AS NEAR-TERM DRIVER LICENSING PRACTICES, RECOMMENDED OPERATIONAL GUIDELINES AND RESEARCH REQUIREMENTS FOR THOSE COMPONENTS OF STATE LICENSING AND REGULATION SYSTEMS THAT HAVE A POTENTIAL SAFETY BENEFIT SHALL BE DEVELOPED.

UNIVERSITY OF NORTH CAROLINA, HIGHWAY SAFETY RESEARCH CENTER, CHAPEL HILL, NORTH CAROLINA 27514  
\$56,489.00

TO BE COMPLETED TEN (10) MONTHS FROM DATE OF CONTRACT AWARD (6 SEP 78).

DOT-HS-8-02022

### ESTABLISHMENT OF THE REPEATABILITY OF PERFORMANCE OF THE SA103C 3-YEAR OLD CHILD TEST DUMMIES

THE SA103C 3-YEAR OLD CHILD TEST DUMMY SHALL UNDERGO CALIBRATION AND SLED TESTING TO DETERMINE, DURING REPEATED TESTS WITH SEVERAL DUMMIES, THE VARIABILITY OF PERFORMANCE MEASUREMENTS FOR THE SAME DUMMY AND FOR SEVERAL DUMMIES. THA

CALSPAN CORPORATION ADVANCED TECHNOL CENTER, 4455 GENESEE STREET (ERIE COUNTY), BUFFALO, NEW YORK 14225  
\$55,759.00

TO BE COMPLETED BY 1 FEB 79.

DOT-HS-8-02026

### COLLISION DEFORMATION CLASSIFICATION TRAINING PROGRAM

A TRAINING PACKAGE SHALL BE PROVIDED THAT WILL INCLUDE BASIC AND ADVANCED TRAINING ON THE USE OF THE CDC (COLLISION DEFORMATION CLASSIFICATION, SAE RECOMMENDED PRACTICE J224A) CODE. THE PURPOSE OF THE TRAINING IS TO IMPROVE THE CONSISTENCY AND ACCURACY OF CDC CODING PROVIDED BY THE NASS (NATIONAL ACCIDENT SAMPLING SYSTEM) INVESTIGATORS.

CALSPAN FIELD SERVICES, INC., 4455 GENESEE STREET, BUFFALO, NEW YORK 14225  
\$40,432.00

TO BE COMPLETED SIX (6) MONTHS FROM DATE OF CONTRACT AWARD (14 SEP 78).

THE FOLLOWING ADDITIONAL COMMENTARIES SHALL BE PREPARED: A TRAFFIC LAWS COMMENTARY ENTITLED "REVIEW OF STATE MOTOR VEHICLE AND TRAFFIC LAWS APPLICABLE TO RAILROAD GRADE CROSSINGS" WHICH SHALL BE BASED ON THE LATEST STATUTES ENACTED BY THE VARIOUS STATES AS COMPARED WITH APPROPRIATE PROVISIONS AND CHAPTERS IN THE MOST CURRENT EDITION OF THE UNIFORM VEHICLE CODE (UVC), STATE LAWS IN EFFECT AS OF JANUARY 1, 1978; AND A TRAFFIC LAWS COMMENTARY ON MODEL LEGISLATION ON MOPEDS FOR SUBMISSION TO STATE LEGISLATURES, WHICH SHALL INCLUDE CONSIDERATION OF DEFINITIONS OF RELEVANT TERMINOLOGY, REGISTRATION OF MOPEDS, LICENSING OF OPERATORS, EQUIPMENT REQUIREMENTS, AND INSPECTION OF SUCH VEHICLES.0 TR

NATIONAL COMMITTEE ON UNIFORM TRAFFIC LAWS AND ORDINANCES, 1776 MASSACHUSETTS AVENUE, N.W., WASHINGTON, D.C. 20036  
INCREASED \$40,000.00  
TO BE COMPLETED BY 31 DEC 78.

DOT-HS-6-01384 MOD. 1

### DEVELOPMENT OF A SOLID PROPELLANT INFLATION TECHNIQUE FOR THE SUBCOMPACT CAR PASSENGER RESTRAINT SYSTEM

THE CONTRACTOR SHALL PROVIDE TECHNICAL SUPPORT OF TECHNICAL PERSONNEL TO CONDUCT THESE TESTS. PERFORMANCE EVALUATION, AS REQUIRED BY THE CONTRACT, SHALL BE PROVIDED BY THE CONTRACTOR. STA

MINICARS, INC., 35 LA PATERA LANE, GOLETA, CALIFORNIA 93017  
INCREASED \$500.00  
EXTENDED TO 30 SEP 78

DOT-HS-7-01599 MOD. 3

### TRAFFIC SAFETY PROGRAMS/MANAGEMENT INFORMATION SYSTEMS

DATA SUPPORT UNDER THE EXISTING TASKS SHALL BE INTENSIFIED TO INCLUDE CONVERSION OF THE 1976 PROGRAM INFORMATION DATA, STANDARDS IMPLEMENTATION STATUS, AND STATE STATISTICS SUMMARY TURNAROUND DOCUMENTS FOR NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) DISTRIBUTION TO THE STATES.

GENASYS CORPORATION, 11300 ROCKVILLE PIKE, ROCKVILLE, MARYLAND 20852  
INCREASED \$7,500.00  
EXTENDED TO 30 SEP 78

DOT-HS-7-01652 MOD. 2

**ESTABLISHMENT OF ZONE CENTERS FOR NASS  
(NATIONAL ACCIDENT SAMPLING SYSTEM)**

TASKS 2 THROUGH 5 ARE MODIFIED AS FOLLOWS: DEVELOP AND TEST COMPUTER LOOK-UP TABLES FOR VALID OIC'S (OCCUPANT INJURY CLASSIFICATIONS) AND CDC'S (COLLISION DEFORMATION CLASSIFICATIONS), WHICH WILL BE PROGRAMMED AND SENT TO THE DATA PROCESSING CONTRACTOR FOR CONSISTENCY CHECK PURPOSES (TASK 2); DEVELOP A QUALITY CONTROL MANUAL OF STANDARD PROCEDURES FOR USE BY ALL THE ZONE CENTERS (TASK 3); DEVELOP A JOB PERFORMANCE STANDARDS MANUAL FOR A NASS (NATIONAL ACCIDENT SAMPLING SYSTEM) INVESTIGATION WHICH WILL BE USED FOR EVALUATION PURPOSES AS A BENCHMARK TO COMPARE TEAM PERFORMANCE AGAINST, AND FOR TRAINING PURPOSES (TASK 4); AND DEVELOP A COMPUTERIZED VERSION OF THE CODING AND EDITING MANUAL WHICH WILL PROVIDE FOR A MORE EFFICIENT MECHANISM FOR CHANGES AND REVISIONS, AND DEVOTE MORE TIME TO THE 1979 REVISION OF THE CSS FORMS (TASK 5). ORIV

INDIANA UNIVERSITY FOUNDATION, 355 NORTH  
LANSING STREET, INDIANAPOLIS, INDIANA 46202  
INCREASED \$78,624.00  
NO CHANGE

DOT-HS-7-01770 MOD. 3

**ELECTRICAL SYSTEM INTEGRITY**

BY UTILIZING DATA GENERATED IN THE BASE CONTRACT AND THE BASE CONTRACT ADD-ON FOR FMVSS NO. 201 COST ESTIMATES, ADDITIONAL ANALYSES SHALL BE PERFORMED TO PROVIDE A REPORT ESTIMATING THE AVERAGE AND RANGE OF CONSUMER COSTS, POUND WEIGHT CHANGES, LIFETIME FUEL OPERATING COST, AND LEADTIME IMPACT IF PASSENGER CAR FMVSS NOS. 203 AND 204 REQUIREMENTS WERE EXTENDED TO LIGHT TRUCKS AND VANS (UNDER 10,000 LBS). IN THE CASE OF FMVSS NO. 204, ANALYSIS OF AN UPGRADED PERFORMANCE LEVEL ALTERNATIVE MUST ALSO BE PERFORMED. THIS UPGRADED LEVEL IS TO REQUIRE A LIMITATION OF VERTICAL DISPLACEMENT TO 2-3 INCHES. THE FMVSS NO. 203 UPGRADE WOULD BE TO PERFORM LAB TESTS AT A VERTICAL ANGLE OF 30° FROM PERPENDICULAR. AND

THE JOHN Z. DELOREAN CORPORATION, POST  
OFFICE BOX 427, BLOOMFIELD HILLS, MICHIGAN  
48013  
INCREASED \$23,873.00  
EXTENDED TO 30 NOV 78

DOT-HS-8-02016

**IDAHO MOTOR VEHICLE INSPECTION PROGRAM**

IN AN EFFECTIVENESS EVALUATION STUDY OF  
IDAHO'S PERIODIC MOTOR VEHICLE INSPECTION

(PMVI) PROGRAM, AN ON-THE-ROAD INSPECTION OF THE MECHANICAL CONDITION OF AT LEAST 1,500 RANDOMLY SELECTED VEHICLES WITH A GROSS WEIGHT RATING OF 10,000 LBS OR LESS, NOT TO INCLUDE MOTORCYCLES OR TRAILERS, SHALL BE CONDUCTED DURING SEPTEMBER, OCTOBER, AND NOVEMBER OF 1978 ("AFTER" PERIOD (IDAHO PMVI DISCONTINUED 30 JUNE 1976)). ONLY VEHICLES WITH AN IDAHO LICENSE PLATE WILL BE INSPECTED. BRAKE LINING INSPECTION WILL BE PERFORMED ON VEHICLES, INCLUDING PICKUPS WITH DRUM FRONT BRAKES, BY PULLING A FRONT WHEEL. ANY METRIC VEHICLE WITH DRUM BRAKES WILL BE EXCLUDED FROM BRAKE LINING INSPECTION. THE INSPECTIONS WILL BE PERFORMED UNDER LEGAL AUTHORITY NOW IN EXISTENCE, AND PARTICIPATION WILL BE ON A VOLUNTARY BASIS.

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."  
\$70,996.00  
TO BE COMPLETED FOUR (4) MONTHS FROM DATE OF CONTRACT AWARD (13 SEP 78).

DOT-HS-8-02016 MOD. 1

**IDAHO MOTOR VEHICLE INSPECTION PROGRAM**

DATA COLLECTED DURING THE OPERATION OF IDAHO'S PERIODIC MOTOR VEHICLE INSPECTION (PMVI) PROGRAM (IMPLEMENTED 1 JAN 1968, DISCONTINUED 30 JUN 1976) SHALL BE ANALYZED IN COMPARISON WITH DATA COLLECTED IN THE "BEFORE" PERIOD OF THE EFFECTIVENESS EVALUATION STUDY OF THE PROGRAM (DATA COLLECTED DURING SEPTEMBER, OCTOBER, AND NOVEMBER 1976). OURI

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."  
INCREASED \$32,099.00  
EXTENDED TO 30 JUN 79

DOT-HS-8-02051

**ADAPTATION AND FURTHER DEVELOPMENT OF  
THE AIS/OIC FOR THE NASS**

PROBLEM AREAS IN THE EXISTING AIS (ABBREVIATED INJURY SCALE) AND OIC (OCCUPANT INJURY CLASSIFICATION) CODES SHALL BE CLARIFIED, AND THE INJURY LISTING SHALL BE EXPANDED, ARRANGING THEM IN A FORMAT THAT WILL SERVE AS A PRACTICAL GUIDE TO INJURY CODING FOR THE TECHNICIAN LEVEL NASS (NATIONAL ACCIDENT SAMPLING SYSTEM) IN-

August 31, 1978

DOT-HS-7-01643 MOD. 4

VESTIGATOR. THE MAJOR OBJECTIVES ARE AS FOLLOWS: DEVELOP A CONCISE NASS INVESTIGATOR'S HANDBOOK FOR INJURY CODING (TO CONTAIN AN EXPANDED DICTIONARY OF OIC/AIS CODES, INJURY CODING CONVENTIONS FOR THE NASS, ANATOMICAL CHARTS FOR REFERENCE, DEFINITIONS OF MEDICAL TERMS USED IN THE NEW DICTIONARY, AND A GLOSSARY OF SYMBOLS COMMONLY FOUND ON MEDICAL INJURY RECORDS); COMPOSE THE EXPANDED DICTIONARY OF OIC/AIS INJURY CODES WITH CAREFUL COORDINATION, CONSULTATION, AND APPROVAL OF THE AAAM-AMA COMMITTEE ON INJURY SCALING; AND ACHIEVE THE STATE-OF-THE-ART IN INJURY CODING BY NASS PROGRAM INVESTIGATORS IN CONJUNCTION WITH THE PUBLICATION OF THE INJURY SCALING COMMITTEE'S 1979 AIS REVISION AND COMMENCEMENT OF THE OFFICIAL DATA COLLECTION IN JANUARY 1979.

HEALTH AND SAFETY ASSOCIATES, INC., P.O. BOX  
222, MORTON GROVE, ILLINOIS 60053  
\$24,513.00  
TO BE COMPLETED FIVE (5) MONTHS FROM DATE OF  
CONTRACT AWARD (26 SEP 78).

DOT-HS-5-01062 MOD. 8

#### STATES' MODEL MOTORIST DATA BASE

THE FOLLOWING TASKS SHALL BE ACCOMPLISHED: COLLECT, REVIEW, DOCUMENT, AND RESPOND TO EACH SUGGESTION AS A RESULT OF A NEGATIVE BALLOT DURING THE PARENT COMMITTEE CONSENSUS PROCESS (TASK 10); MAKE CHANGES TO DICTIONARY, IF REQUIRED, AS A RESULT OF PARENT COMMITTEE VOTE AND SUGGESTIONS (TASK 11); DISTRIBUTE THE PARENT COMMITTEE-APPROVED DICTIONARY NATIONWIDE (TASK 12); AND PREPARE NECESSARY MATERIALS FOR SUBMISSION OF DICTIONARY TO THE AMERICAN NATIONAL STANDARDS INSTITUTE (TASK 13).

AMERICAN ASSOCIATION OF MOTOR VEHICLE  
ADMINISTRATORS, SUITE 910, 1201 CONNECTICUT  
AVENUE, NW, WASHINGTON, D.C. 20036  
INCREASED \$19,942.37  
TO BE COMPLETED BY 31 DEC 78.

DOT-HS-5-01266 MOD. 4

#### ACCIDENT ANALYSIS--BREAKAWAY AND NON-BREAKAWAY POLES INCLUDING SIGN AND LIGHT STANDARDS ALONG HIGHWAYS

DATA FROM AT LEAST ONE THOUSAND (1,000) ADDITIONAL ACCIDENTS INVOLVING COLLISIONS WITH POLES SHALL BE PROVIDED, THROUGH INVESTIGATION AND RECONSTRUCTION OF THE DYNAMIC AND DAMAGE PARAMETERS OF SUCH COLLISIONS, AS FOLLOWS: TYPES OF POLES, LUMINARIES AND LARGE SIGNS (GREATER THAN 4 INCHES); POLE CATEGORY, BREAKAWAY AND NON-BREAKAWAY; AND VEHICLE SIZE, SMALL (LESS THAN OR EQUAL TO 2,500 LBS) AND LARGE (GREATER THAN 2,500 LBS). EACH MONTHLY STUDY PROGRESS REPORT SHALL

DISPLAY THE MATRIX AS REQUIRED OF THE PLANNED SAMPLE IN ORDER TO ADJUST THE COLLECTION EFFORTS WHEN CERTAIN CELLS ARE BEING NEGLECTED AND OTHERS BEING OVER-REPRESENTED. THE STATISTICAL ANALYSIS OF THE DATA SHALL BE STRUCTURED TO DETERMINE THE RELATIONSHIP(S) BETWEEN THE PERFORMANCE OF VARIOUS BREAKAWAY AND NON-BREAKAWAY POLES FOR DIFFERENT VEHICLE SIZES AND LEVELS OF CRASHWORTHINESS. THE TOTAL SAMPLE OF 2,000 ACCIDENTS SHALL BE CONTAINED IN THE STATISTICAL ANALYSIS PLAN. THE MAGNITUDE OF THE VARIOUS DIFFERENCES THAT RESULT FROM THE STATISTICAL ANALYSIS SHALL BE INCORPORATED IN THE COST-EFFECTIVENESS ANALYSIS.

SOUTHWEST RESEARCH INSTITUTE, 8500 CULEBRA  
ROAD, SAN ANTONIO, TEXAS 78284  
INCREASED \$300,000.00  
EXTENDED TO 30 MAR 80

DOT-HS-7-01563 MOD. 4

#### IMPACT OF MOTORCYCLE HELMET USAGE IN KANSAS

THE KANSAS MOTORCYCLE HELMET USAGE OBSERVATIONAL STUDY SHALL BE EXTENDED TO INCLUDE COLLECTION OF MOTORCYCLE ACCIDENT AND EXPOSURE DATA FOR 1977 AND 1978. FOR ACCIDENT DATA, THE LIST OF INFORMATION TO BE GATHERED IS CHANGED TO INCLUDE THE ADDITIONAL ITEM OF SINGLE VEHICLE VS. MULTI-VEHICLE ACCIDENTS (APPLICABLE TO 1977 AND 1978 ACCIDENT REPORTING). FOR THE INJURY SEVERITY DATA, MONTHLY AND ANNUAL MOTORCYCLE STATISTICS AND EXPOSURE DATA SUCH AS REGISTRATIONS, NUMBER OF LICENSED DRIVERS, ETC., SHALL BE COLLECTED FROM STATE AND LOCAL SOURCES FOR AREAS OF THE STUDY COVERED (1977 AND 1978 ACCIDENT REPORTS). ALSO, AN ECONOMIC IMPACT STUDY OF THE REPEAL OF THE MANDATORY MOTORCYCLE HELMET LAWS SHALL BE CONDUCTED, BASED UPON THOSE ACCIDENT VICTIMS IDENTIFIED IN THIS STUDY (APPLICABLE TO 1977 AND 1978 ACCIDENT REPORTS)0LE

UNIVERSITY OF KANSAS MEDICAL CENTER,  
EMERGENCY MEDICAL TRAINING, 39TH AND  
RAINBOW BLVD., BUILDING 47, KANSAS CITY,  
KANSAS 66103  
INCREASED \$52,771.00  
EXTENDED TO 31 AUG 79

DOT-HS-7-01643 MOD. 4

#### DEVELOPMENT AND APPLICATION OF ANALYTICAL AND STATISTICAL METHODS IN VEHICLE STRUCTURES RESEARCH II

WORK SHALL BE CONTINUED UNDER EXISTING TASKS 1.2, 3.0, 4.0, 5.0, AND 5.4, AS FOLLOWS: EXPAND 1.2 TO INCLUDE DEVELOPMENT AND UTILIZATION WORK WITH THE SMAC (SIMULATION MODEL OF AUTOMOBILE COLLISIONS) AND CRASH (CALSPAN

RECONSTRUCTION OF ACCIDENT SPEEDS ON THE HIGHWAY) COMPUTER PROGRAMS; CONVERT THOSE PORTIONS OF THE DATA BASE MANAGEMENT SYSTEM SOFTWARE WRITTEN IN FORTRAN, REQUIRED BY 3.0, TO MACRO TO INCREASE THE COMPUTER EFFICIENCY OF THE SOFTWARE, AND REFINE THE DATA BASE MANAGEMENT SYSTEM WHERE NECESSARY TO PROVIDE MORE EFFICIENT AND RELIABLE HANDLING OF TEST DATA; CONTINUE AND COMPLETE 4.0 DEVELOPMENT OF THE STATIC CRUSH TEST DATA BASE CONTINGENT UPON RECEIVING THE FORMAT FOR THESE DATA; EXPAND 5.0 TO INCLUDE WORK WITH BASIC ORDERING AGREEMENT TEST CONTRACTORS TO FAMILIARIZE THEM WITH THE REQUIREMENTS OF THE DATA BASE MANAGEMENT SYSTEM FOR PROCESSING THEIR TEST DATA; AND PROVIDE A MORE COMPREHENSIVE ANALYSIS OF THE 5.4 DYNAMIC DATA ANALYSIS AND PROCESSING TO CONSIDER DIFFERENT TYPES OF DATA FILTERING WHICH MAY BE USED. THE

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

INCREASED \$114,774.00  
EXTENDED TO 30 SEP 79

DOT-HS-7-01790 MOD. 3

#### **AUGMENTATION OF RESEARCH AND ANALYSIS CAPABILITIES FOR TIMELY SUPPORT OF AUTOMOTIVE FUEL ECONOMY ACTIVITIES**

A CRITICAL SUMMARY SHALL BE PREPARED OF THE DIESEL PARTICULATE WORKSHOP HELD FOLLOWING THE FUEL ECONOMY CONTRACTORS' COORDINATION MEETING ON APRIL 27-28. THE SUMMARY SHALL BE BASED ON THE INPUTS OF THE TEAM OF EXPERTS, IN EACH OF THE FOUR AREAS COVERED IN THE WORKSHOP. THE PAPER WILL CONSIST OF SUMMARIES THAT COVER THE FOLLOWING: ISSUES COVERED AT THE WORKSHOP AND THE EXPERTS' ASSESSMENT OF THE POSITION PRESENTED, ISSUES NOT COVERED AT THE WORKSHOP THAT ARE CONSIDERED OF MAJOR IMPORTANCE, AND A LIST OF OPEN ISSUES FOR THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) TO CONSIDER IN ORDER OF THEIR PRIORITY. ALSO, A ONE-DAY BRIEFING SHALL BE PRESENTED TO NHTSA, AT RIVERSIDE, CALIFORNIA, IN WHICH THE RESULTS OF THE SUMMARY WILL BE PRESENTED BY THE TEAM OF EXPERTS AND DISCUSSED WITH NHTSA PERSONNEL. ODE

SOUTH COAST TECHNOLOGY, INC., POST OFFICE BOX 3205, SANTA BARBARA, CALIFORNIA 93106  
INCREASED \$24,959.00  
TO BE COMPLETED FIVE (5) WEEKS FROM DATE OF MODIFICATION AWARD (29 SEP 78).

DOT-HS-8-01952

#### **TRAFFIC LAWS ANNOTATED: STATE TRAFFIC LAWS ANNOTATED; DRIVER LICENSING LAWS ANNOTATED; TRAFFIC COMMENTARY: "RULES OF THE ROAD RATED"**

THE FOLLOWING MANUSCRIPTS SHALL BE RESEARCHED, PREPARED, AND DELIVERED: THE SIXTH ANNUAL SUPPLEMENT TO "TRAFFIC LAWS ANNOTATED" (TLA) WHICH SHALL INCLUDE ANNOTATIONS OF STATE MOTOR TRAFFIC LAWS IN EFFECT AS OF 1 JAN 1979, INCLUDING THOSE IN EFFECT IN THE COMMONWEALTH OF PUERTO RICO, AS COMPARED WITH CHAPTERS 10, 11, AND 15 OF THE LATEST EDITION OF THE "UNIFORM VEHICLE CODE" (UVC); THE FIFTH ANNUAL SUPPLEMENT TO "DRIVER LICENSING LAWS ANNOTATED" (DLLA), WHICH SHALL INCLUDE ANNOTATIONS OF STATE DRIVER LICENSING LAWS IN EFFECT AS OF 1 JAN 1979, AS COMPARED WITH CHAPTER 6 OF THE LATEST EDITION OF THE UVC; AND THE ANNUAL "TRAFFIC LAWS COMMENTARY" ENTITLED "RULES OF THE ROAD," WHICH SHALL BE BASED ON THE LATEST LAWS ENACTED BY THE STATES, THE DISTRICT OF COLUMBIA, AND THE COMMONWEALTH OF PUERTO RICO AS COMPARED WITH CHAPTER 11 (RULES OF THE ROAD) OF THE LATEST EDITION OF THE UVC COVERING ALL APPLICABLE STATE TRAFFIC LAWS IN EFFECT AS OF 31 DEC 1977.

NATIONAL COMMITTEE ON UNIFORM TRAFFIC LAWS AND ORDINANCES, 1776 MASSACHUSETTS AVENUE, N.W., SUITE 430, WASHINGTON, D.C. 20036  
\$70,000.00  
TO BE COMPLETED ONE (1) YEAR FROM DATE OF CONTRACT AWARD (13 SEP 78).

DOT-HS-8-01990

#### **NOVICE DRIVER EVALUATION PROJECT**

DATA SHALL BE COLLECTED AND ANALYZED IN ORDER TO EVALUATE THE ACCIDENT AND VIOLATION REDUCTION EFFECTIVENESS OF THE NEW NOVICE DRIVER SYSTEM (NDS) FOR DRIVERS FROM AGE 16 THROUGH AGE 19. TO EVALUATE THE NDS, 18,000 NOVICE DRIVERS FROM THE NEW SYSTEM AND 12,000 SUBJECTS FROM THE OLD SYSTEM SHALL BE RANDOMLY SELECTED. THESE SAMPLES WILL BE SUBDIVIDED INTO TWO EQUAL CATEGORIES, THOSE WHO HAD BEHIND-THE-WHEEL DRIVER EDUCATION AND THOSE WHO DID NOT. ALL DRIVING RECORDS WILL BE TRACKED FROM PERMIT ISSUANCE THROUGH THREE YEARS AFTER LICENSURE. STATISTICAL ANALYSES WILL BE PERFORMED ON THE DATA GATHERED, AND THE RESULTS WILL FACILITATE EVALUATION OF ALL ASPECTS OF THE NDS.

STATE OF NEW JERSEY, OFFICE OF HIGHWAY SAFETY, 4 SCOTCH ROAD, TRENTON, NEW JERSEY 08628  
\$209,400.00  
TO BE COMPLETED BY 31 MAR 84.

DOT-HS-8-02004

A TWO AND ONE-HALF DAY CONFERENCE TO REVIEW THE FINAL RESULTS OF THE TWO COMPLETED NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) SPECIAL ADJUDICATION FOR ENFORCEMENT (SAFE) DEMONSTRATION PROJECTS (SEATTLE, WASHINGTON AND RHODE ISLAND STATE) AND TO REVIEW THE METHODS ADOPTED BY STATES TO IMPROVE TRAFFIC CASE PROCESSING. SHALL BE PLANNED, ARRANGED, AND CONDUCTED. THE RESULTS OF NHTSA'S RESEARCH AND DEVELOPMENT CONTRACT ON "DECRIMINALIZATION" SHALL BE INCLUDED IN THE REVIEW

DOT-HS-8-02017

IN RELATION TO DRIVER LICENSING, A PROBLEM ANALYSIS SHALL BE MADE OF MULTIPLE LICENSING, THE 1969 "DRIVER LICENSING GUIDELINES FOR MEDICAL ADVISORY BOARDS" SHALL BE UPDATED, AND THE 1977 "COMPARATIVE DATA AND ANALYSIS IN STATE MOTOR VEHICLE ADMINISTRATION" SHALL BE UPDATED.

AMERICAN ASSOCIATION OF MOTOR VEHICLE  
ADMINISTRATORS, SUITE 910, 1201 CONNECTICUT  
AVENUE, N.W., WASHINGTON, D.C. 20036  
\$67,660.15  
TO BE COMPLETED BY 31 DEC 79

DOT-HS-8-02020

THE FOLLOWING THREE TASKS SHALL BE PERFORMED DURING RESEARCH PERIODS 1, 2, AND 3:

1. DEVELOP AND VALIDATE TWO DIFFERENT METHODOLOGIES TO REDUCE THE NOISE RADIATED BY TIRE VIBRATION: DEVELOP A DRIVE SIGNAL PROCESSING TECHNIQUE TO SEPARATE THE ROAD- AND THE TREAD-RELATED COMPONENTS OF THE TIRE-ROAD INTERACTION NOISE SPECTRA; COMPARE WET ROAD AND DRY ROAD TIRE VIBRATION SPECTRA TO DETERMINE THE CONTRIBUTION OF EACH TO THE TOTAL TIRE-ROAD INTERACTION SPECTRA; DEVELOP A MECHANISM OF VIBRATION-INDUCED NOISE, AND EXPERIMENTALLY AND ANALYTICALLY VALIDATE THE MECHANISM.

CALLY DESCRIBE THE WAVE PROPAGATION  
PHENOMENON IN THESE STRUCTURES. TA

NORTH CAROLINA STATE UNIVERSITY, RALEIGH,  
NORTH CAROLINA 27695  
\$59,271.00  
TO BE COMPLETED WITHIN SEVEN (7) MONTHS  
FROM DATE OF CONTRACT AWARD (2 SEP 78).

## FATAL ACCIDENT REPORTING SYSTEM (FARS) DATA ENHANCEMENT

A DATA ENHANCEMENT STUDY SHALL BE CONDUCTED FOR THE FATAL ACCIDENT REPORTING SYSTEM (FARS) QDD

KINETIC RESEARCH, INC., 6613 SEYBOLD ROAD,  
MADISON, WISCONSIN 53719  
\$99,855.00  
FROM DATE OF CONTRACT AWARD (14 SEP 78) UNTIL  
AMENDED

DOT-11S-8-02027

# IMPLEMENTATION OF NON-RESIDENT VIOLATOR COMPACT OF 1977

IN ORDER TO  
TO OBTAIN  
OPERATIONAL  
VIOLATOR (COMM-FAC) 1.  
NATIONALS, NATIONAL, CHINA, RM  
THE FACILITATING COMMISSION II. THE  
FACILITATING

AMERICAN ASSOCIATION OF MOTOR VEHICLE  
ADMINISTRATORS, SUITE 800, 1301 CONNECTICUT  
AVENUE, N.W., WASHINGTON, D.C. 20036  
\$35,618.23  
TO BE COMPLETED BY 11/1/87

11. *Journal of the American Medical Association*, 277, 1996, 1661-1665.

[illegible]

DOT-HS-8-02030

HSL 78-08

DOT-HS-8-02030

**TECHNOLOGY ADVANCEMENT FOR DETERRENCE OF SPEEDING**

FIRST, THE POTENTIAL UTILITY OF ALL NEW TECHNOLOGY DEVELOPMENTS THAT ARE BEING (OR HAVE BEEN) USED FOR SPEED CONTROL IN THE U.S., WESTERN EUROPE, CANADA, AND JAPAN, SHALL BE IDENTIFIED AND ASSESSED, AS WELL AS THE POTENTIAL UTILITY OF NEW TECHNOLOGICAL ADVANCES NOT YET IMPLEMENTED FOR SPEED CONTROL. SECOND, BASED ON THE POTENTIAL UTILITY ASSESSMENT, A MINIMUM OF THREE (3) DEVICES SHALL BE SELECTED FOR FIELD TESTING TO DETERMINE THEIR EFFECT ON SPEEDING (55 MPH VIOLATIONS), AS WELL AS ON SPEED REDUCTION AT LOCATIONS OF ACCIDENTS PRECIPITATED BY SPEEDING. A REPORT SHALL BE PREPARED WHICH IS SUITABLE FOR DISSEMINATION TO STATE AND LOCAL POLICE TRAFFIC ENFORCEMENT AGENCIES AND WHICH DETAILS THE OPERATIONAL REQUIREMENTS FOR THE TECHNOLOGICAL ADVANCES EXAMINED, SPECIFIES THEIR POTENTIAL UTILITY, AND DOCUMENTS THE RESULTS OF THE FIELD TEST.

MIDWEST RESEARCH INSTITUTE, 425 VOLKER  
BOULEVARD, KANSAS CITY, MISSOURI 64110  
\$244,205.00  
TO BE COMPLETED EIGHTEEN (18) MONTHS FROM  
DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02031

**WORKSHOP TO REVIEW PROBLEM-BEHAVIOR RESEARCH PROGRAMS**

A SERIES OF WORKSHOPS TO REVIEW PROBLEM-BEHAVIOR RESEARCH PROGRAMS SHALL BE ORGANIZED AND CONDUCTED WHICH ARE COMPOSED OF SELECTED INDIVIDUALS WHO ARE EXPERTS IN THE DRIVER AND PEDESTRIAN RESEARCH AREAS, WHO ARE KNOWLEDGEABLE IN SUCH AREAS AS RESEARCH METHODOLOGY, ANALYTIC METHODS, LEGAL CONSTRAINTS, AND NATIONAL POLICY AS RELATED TO HIGHWAY SAFETY, AND WHO ARE REPRESENTATIVE OF THE VARIOUS USER GROUPS. FOUR WORKSHOPS WILL BE CONDUCTED; THREE WILL COVER SPECIFIC NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) RESEARCH PROGRAM AREAS, ALCOHOL RESEARCH, PEDESTRIAN SAFETY AND BICYCLIST SAFETY RESEARCH, AND SAFE DRIVING CONFORMANCE RESEARCH; THE FOURTH WORKSHOP WILL TREAT THE MORE SPECIFIC PLANS RELATED TO ALCOHOL GENERAL DETERRENCE. THE OUTPUTS FROM THESE WORKSHOPS WILL CONSIST OF A SERIES OF REPORTS, ONE FOR EACH WORKSHOP. THE REPORTS WILL DESCRIBE WORKSHOP ACTIVITIES AS WELL AS PROVIDE SUMMARIES OF THE CRITICAL REVIEW

AND SUGGESTIONS THAT WERE DEVELOPED BY THE PARTICIPANTS. OS O

THE UNIVERSITY OF MICHIGAN, 260 RESEARCH  
ADMINISTRATION BLDG., ANN ARBOR, MICHIGAN  
48109  
\$83,160.00  
1 OCT 78 THROUGH 30 SEP 79

DOT-HS-8-02034

**SURVEY OF OWNERS OF MOTOR VEHICLES FOR SAFETY RELATED DEFECTS**

THE FOLLOWING TASKS SHALL BE ACCOMPLISHED IN CONDUCTING SAFETY-RELATED DEFECTS (SRD) INVESTIGATIONS: SEARCH DATA RECORDS AND DESIGN QUESTIONNAIRES, WHERE NECESSARY; SELECT NAMES (OF CURRENT OWNERS OF PARTICULAR MAKES, MODELS, AND MODEL YEARS OF MOTOR VEHICLES) IN ACCORDANCE WITH THE PRINCIPLES OF PROBABILITY RANDOM SAMPLING; MAIL QUESTIONNAIRES TO VEHICLE OWNERS; CODE RESPONSES FROM QUESTIONNAIRES; AND ANALYZE THE DATA RECEIVED. COMPLETE DOCUMENTATION OF ALL FACTS IS VITAL TO AN INVESTIGATION. ALL NEW INFORMATION SHALL BE INTEGRATED WITH PREVIOUS DATA FOR COMPARISON, WHERE PERTINENT. DRI

MARKET FACTS, INC., 1750 K STREET, N.W.,  
WASHINGTON, D.C. 20006  
\$50,000.00

TO BE COMPLETED ONE (1) YEAR FROM DATE OF  
CONTRACT AWARD (27 SEP 78).

DOT-HS-8-02038

**OWNER MANUALS FOR SERVICE AND REPAIR OF FMVSS 121 AIR BRAKE SYSTEMS**

SERVICE AND REPAIR MANUALS COVERING THE FMVSS 121 ANTI-LOCK SYSTEM, SPECIFICALLY DESIGNED FOR USE BY THE INDIVIDUAL TRUCK OWNER-OPERATOR IN SERVICING AND REPAIRING THIS SYSTEM, SHALL BE DEVELOPED, TESTED, AND EVALUATED. THE PROJECT REQUIRES THE PREPARATION OF AN OVERALL GENERAL MANUAL COVERING THE FUNDAMENTALS OF THE FMVSS 121 AIR BRAKE SYSTEM PERFORMANCE AND FOUR ADDITIONAL MANUALS COVERING DESIGNATED MANUFACTURER'S ANTI-LOCK SYSTEMS AND THEIR COMPONENTS.

KINTON, INCORPORATED, SUITE 508 - 4660 KENMORE  
AVENUE, ALEXANDRIA, VIRGINIA 22304  
\$92,904.00  
TO BE COMPLETED FOUR HUNDRED AND TWENTY  
(420) DAYS FROM DATE OF CONTRACT AWARD (28 SEP  
78).



August 31, 1978

DOT-HS-8-02049

DOT-HS-8-02040

### **EVALUATION OF EMERGENCY MEDICAL SERVICES PROGRAMS**

PENNSYLVANIA'S EMERGENCY MEDICAL SERVICES (EMS) PROGRAM SHALL BE EVALUATED. THE AREA OF INTEREST IS THE EFFECTIVENESS OF THE EMS SYSTEM IN TERMS OF ITS IMPACT ON THE REDUCTION OF ACCIDENT INJURY SEVERITY, MORTALITY, AND MORBIDITY. IF THESE TYPES OF IMPACT MEASURES ARE UNAVAILABLE, STUDIES MAY BE DIRECTED TO THE EVALUATION OF IMPROVEMENTS TO THE EMS SYSTEM AS REFLECTED THROUGH CHANGES IN INTERMEDIATE MEASURES, SUCH AS RESPONSE TIME.

PENNSYLVANIA DEPT. OF HEALTH, BUREAU OF HEALTH RESEARCH, P.O. BOX 90, ROOM 725, HARRISBURG, PA 17120  
\$17,883.00  
TO BE COMPLETED ONE (1) YEAR FROM DATE OF CONTRACT AWARD (27 SEP 78).

DOT-HS-8-02041

### **EVALUATION OF EMERGENCY MEDICAL SERVICES PROGRAMS**

NEBRASKA'S EMERGENCY MEDICAL SERVICES (EMS) PROGRAM SHALL BE EVALUATED. THE AREA OF INTEREST IS THE EFFECTIVENESS OF THE EMS SYSTEM IN TERMS OF ITS IMPACT ON THE REDUCTION OF ACCIDENT INJURY SEVERITY, MORTALITY, AND MORBIDITY. IF THESE TYPES OF IMPACT MEASURES ARE UNAVAILABLE, STUDIES MAY BE DIRECTED TO THE EVALUATION OF IMPROVEMENTS TO THE EMS SYSTEM AS REFLECTED THROUGH CHANGES IN INTERMEDIATE MEASURES, SUCH AS RESPONSE TIME. OYST

STATE OF NEBRASKA, DEPARTMENT OF HEALTH, 301 CENTENNIAL MALL SO., BOX 95007, LINCOLN, LANCASTER CO., NEBRASKA 68509  
\$33,618.00  
TO BE COMPLETED ONE (1) YEAR FROM DATE OF CONTRACT AWARD (27 SEP 78).

DOT-HS-8-02042

### **EVALUATION OF EMERGENCY MEDICAL SERVICES PROGRAMS**

WASHINGTON STATE'S EMERGENCY MEDICAL SERVICES (EMS) PROGRAM SHALL BE EVALUATED. THE AREA OF INTEREST IS THE EFFECTIVENESS OF THE EMS SYSTEM IN TERMS OF ITS IMPACT ON THE REDUCTION OF ACCIDENT INJURY SEVERITY, MORTALITY, AND MORBIDITY. IF THESE TYPES OF IMPACT MEASURES ARE UNAVAILABLE, STUDIES MAY BE DIRECTED TO THE EVALUATION OF IMPROVEMENTS TO THE EMS SYSTEM AS REFLECTED THROUGH CHANGES IN INTERMEDIATE MEASURES, SUCH AS RESPONSE TIME.

MILITARY AID TO SAFETY AND TRAFFIC (MAST) COMMITTEE, STATE OF WASHINGTON, INC., 801

BROADWAY, SUITE 927, SEATTLE, WASHINGTON 98122  
\$34,290.00  
TO BE COMPLETED ONE (1) YEAR FROM DATE OF CONTRACT AWARD (27 SEP 78).

DOT-HS-8-02043

### **EVALUATION OF EMERGENCY MEDICAL SERVICES PROGRAMS**

MAINE'S EMERGENCY MEDICAL SERVICES (EMS) PROGRAM SHALL BE EVALUATED. THE AREA OF INTEREST IS THE EFFECTIVENESS OF THE EMS SYSTEM IN TERMS OF ITS IMPACT ON THE REDUCTION OF ACCIDENT INJURY SEVERITY, MORTALITY, AND MORBIDITY. IF THESE TYPES OF IMPACT MEASURES ARE UNAVAILABLE, STUDIES MAY BE DIRECTED TO THE EVALUATION OF IMPROVEMENTS TO THE EMS SYSTEM AS REFLECTED THROUGH CHANGES IN INTERMEDIATE MEASURES, SUCH AS RESPONSE TIME. NGE

MEDICAL CARE DEVELOPMENT, INC., 295 WATER STREET, KENNEBEC COUNTY, AUGUSTA, MAINE 04330  
\$34,293.00  
TO BE COMPLETED ONE (1) YEAR FROM DATE OF CONTRACT AWARD (27 SEP 78).

DOT-HS-8-02048

### **55 MPH IMPACT PROGRAM EVALUATION**

AN EVALUATION PROGRAM SHALL BE DEVELOPED AND IMPLEMENTED TO STUDY THE IMPACT OF THE 55 MPH SPEED LIMIT IN CONNECTICUT.

CONNECTICUT STATE POLICE DEPARTMENT, 100 WASHINGTON AVENUE, HARTFORD, CONNECTICUT 06101  
\$658,165.00  
TO BE COMPLETED BY 30 NOV 80.

DOT-HS-8-02049

### **HUMAN FACTORS ANALYSIS OF AUTOMOTIVE ADAPTIVE EQUIPMENT FOR DISABLED DRIVERS**

A DETERMINATION SHALL BE MADE OF WHAT HUMAN FACTORS REQUIREMENTS ARE NEEDED FOR AUTOMOTIVE ADAPTIVE EQUIPMENT (AAE) TO IMPROVE HANDICAPPED DRIVER PERFORMANCE (IN ADDITION TO THE REQUIREMENT THAT HAND BRAKE/ACCELERATOR CONTROLS BE PUSHED FORWARD FOR BRAKE ACTUATION, AND THE REQUIREMENT THAT ACCELERATOR ACTUATION BE A DISTINCTLY DIFFERENT MOTION FROM BRAKE ACTUATION (AS STATED IN THE VETERANS ADMINISTRATION'S (VA) RECENT STANDARD TO UPGRADE THE SAFETY OF DRIVING AIDS FOR PASSENGER CARS USED BY DISABLED VETERANS WHO HAVE LOSS OR PARALYSIS OF LIMBS)). THE REQUIREMENTS WOULD FORM THE BASIS FOR THE NA-

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) TO ISSUE A MOTOR VEHICLE SAFETY STANDARD TO UPGRADE THE CURRENT SPECIFICATIONS OF THE VA STANDARD.

TEXAS A AND M RESEARCH FOUNDATION, FACULTY EXCHANGE BOX H, COLLEGE STATION, TEXAS 77843  
\$103,803.00  
TO BE COMPLETED TWENTY-FOUR (24) MONTHS FROM DATE OF CONTRACT AWARD (30 SEP 78).

DOT-HS-8-02052

#### **FIELD TEST OF THE DRUNK DRIVING WARNING SYSTEM**

A FIELD STUDY SHALL BE CONDUCTED WITH THE DRUNK DRIVING WARNING SYSTEM (DDWS), BASED ON THE CRITICAL TRACKING TEST, FOR THE PURPOSE OF DETERMINING THE POTENTIAL UTILITY OF THE DDWS IN DETERRING (OR INTERFERING WITH) DWI (DRIVING WHILE INTOXICATED) TRIPS FOR A TARGET GROUP (E.G. CONVICTED DWI'S) AND FOR THE PURPOSE OF UNDERSTANDING AND SOLVING PRACTICAL OPERATIONAL ISSUES RELATED TO THE IMPLEMENTATION OF SUCH A SYSTEM IN THE FIELD

SYSTEMS TECHNOLOGY, INC., 13766 S. HAWTHORNE BLVD., HAWTHORNE, CALIFORNIA 90250  
\$449,900.00  
TO BE COMPLETED THIRTY-FOUR (34) MONTHS FROM DATE OF CONTRACT AWARD (30 SEP 78).

DOT-HS-8-02054

#### **PROBLEM IDENTIFICATION TECHNICAL ASSISTANCE**

ON-SITE TECHNICAL ASSISTANCE SHALL BE PROVIDED TO STATES WHERE THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) DATA ANALYSIS AND REPORTING TECHNIQUES (DART) SYSTEM, A COMPUTER SOFTWARE STATISTICAL PACKAGE DESIGNED AND DEVELOPED TO ASSIST IN THE SELECTION, ANALYSIS, AND EVALUATION OF ACCIDENT DATA, HAS BEEN INSTALLED. THIS ASSISTANCE WOULD INVOLVE THE APPLICATION OF THE STEP-BY-STEP APPROACH CONTAINED IN THE "PROBLEM IDENTIFICATION MODEL WORKBOOK" WHICH USES DART SOFTWARE CAPABILITIES TO IDENTIFY HIGHWAY SAFETY PROBLEMS. THE CANDIDATE STATES FOR RECEIVING THE ON-SITE TECHNICAL ASSISTANCE ARE NEBRASKA, SOUTH DAKOTA, CALIFORNIA, NEW YORK, MARYLAND, WASHINGTON, OREGON, PENNSYLVANIA, MINNESOTA, OHIO, KANSAS, MISSOURI, NEW HAMPSHIRE, VERMONT, ALABAMA, TENNESSEE, TEXAS, NEW MEXICO, UTAH, AND WYOMING.

NATIONAL CON-SERV, INC., T/A, SAFETY MANAGEMENT INSTITUTE, 7979 OLD GEORGETOWN ROAD, BETHESDA, MARYLAND 20014  
\$98,905.00  
TO BE COMPLETED NINE (9) MONTHS FROM DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02055

#### **MATERIAL DEVELOPMENT FOR TRAINING FOR OPERATORS OF SPEED MEASURING DEVICES (SMDS)**

INSTRUCTIONAL PROGRAM (CURRICULUM) MATERIALS FOR THE TRAINING OF TRAFFIC ENFORCEMENT PERSONNEL IN THE USE OF SPEED MEASURING DEVICES (SMD'S) SHALL BE DEVELOPED, TESTED, AND EVALUATED. THE TRAINING PROGRAM WILL BE DESIGNED TO INCREASE THE CREDIBILITY OF THE RESULTS OF SMD'S AND TO THOROUGHLY FAMILIARIZE THE TRAINEES WITH THE USE OF SMD'S.

DUNLAP AND ASSOCIATES, INC., ONE PARKLAND DRIVE, DARIEN, FAIRFIELD, CONNECTICUT 06820  
\$76,045.00  
TO BE COMPLETED FOURTEEN (14) MONTHS FROM DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02056

#### **SEAT BELT USAGE WORKSHOPS FOR STATE OFFICIALS**

TEN (10) TWO-DAY REGIONAL WORKSHOPS (ONE IN EACH OF THE TEN NHTSA REGIONS) ON TECHNIQUES TO INCREASE SAFETY BELT USAGE (SBU) SHALL BE ORGANIZED AND BE CONDUCTED DURING THE EARLY SPRING OF 1979. THE PURPOSE OF THE WORKSHOPS WILL BE TO EXPLAIN CONTENTS OF THE RECENTLY PUBLISHED NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) MANUAL AND OTHER SBU MATERIALS, AND TO ENCOURAGE IMPLEMENTATION OF THEIR RECOMMENDATIONS. A FINAL REPORT OUTLINING THE HIGHLIGHTS OF THE WORKSHOPS AND THE GENERAL STATE OF THE ART OF SBU PROGRAMMING SHALL ALSO BE PREPARED. 0ROB

NATIONAL SAFETY COUNCIL, 444 NORTH MICHIGAN AVENUE, CHICAGO, ILLINOIS 60611  
\$83,622.00  
TO BE COMPLETED TWELVE (12) MONTHS FROM DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02057

#### **SEAT BELT USAGE WORKSHOPS FOR STATE OFFICIALS**

TEN (10) TWO-DAY REGIONAL WORKSHOPS (ONE IN EACH OF THE TEN NHTSA REGIONS) ON TECHNIQUES TO INCREASE SAFETY BELT USAGE (SBU) SHALL BE ORGANIZED AND BE CONDUCTED DURING THE EARLY SPRING OF 1979. THE PURPOSE OF THE WORKSHOPS WILL BE TO EXPLAIN CONTENTS OF THE RECENTLY PUBLISHED NHTSA (NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION) MANUAL AND OTHER SBU MATERIALS, AND TO ENCOURAGE IMPLEMENTATION OF THEIR RECOMMENDATIONS. A FINAL REPORT OUTLINING THE HIGHLIGHTS OF THE WORKSHOPS AND THE

August 31, 1978

DOT-HS-8-02065

GENERAL STATE OF THE ART OF SBU PROGRAMMING SHALL ALSO BE PREPARED.

UNIVERSITY OF NORTH CAROLINA, HIGHWAY SAFETY RESEARCH CENTER, CHAPEL HILL, NORTH CAROLINA 27514

\$69,254.00

TO BE COMPLETED TWELVE (12) MONTHS FROM DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02058

#### **TRAINING MATERIAL DEVELOPMENT**

A TRAINING CURRICULUM SHALL BE DEVELOPED WHICH WILL BE FOLLOWED IN THE INSTRUCTION OF DATA ANALYSIS TO USE THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S (NHTSA) DART (DATA ANALYSIS AND REPORTING TECHNIQUES) SYSTEM, A SET OF COMPUTER STATISTICAL PROGRAMS IN SINGLE PACKAGE FORM DESIGNED TO ASSIST THE STATES IN THEIR ANALYSIS OF COMPUTER-MAINTAINED ACCIDENT DATA BY PRODUCING THE ANALYTICAL REPORTS NEEDED FOR PROBLEM IDENTIFICATION AND PROGRAM EVALUATION. A TRAINING CURRICULUM PACKAGE CONSISTING OF A COURSE GUIDE, INSTRUCTOR'S MANUAL, TRAINEE MANUAL, AND VISUAL AIDS FOR THE TRAINING OF STATISTICAL ANALYSTS AND PROGRAM PLANNERS IN THE USE OF DART SYSTEM, WILL BE DEVELOPED, TESTED, AND EVALUATED.

DUNLAP AND ASSOCIATES, INC., ONE PARKLAND DRIVE, DARIEN, FAIRFIELD, CONNECTICUT 06820

\$67,317.00

TO BE COMPLETED FIFTEEN (15) MONTHS FROM DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02059

#### **DUAL SPEED COUNTERS**

IN CONJUNCTION WITH CONNECTICUT'S 55 MPH IMPACT EVALUATION PROJECT, TEN (10) DUAL SPEED COUNTERS, MODEL CVS-545-L/C, INCLUDING SHROUDS FOR THE LED DISPLAY, AND AUXILIARY SUPPORT EQUIPMENT SHALL BE PROVIDED; STATE PERSONNEL SHALL BE TRAINED IN THE INSTALLATION, OPERATION, AND ON-SITE MAINTENANCE OF THE CVS AND ANCILLARY SUPPORT EQUIPMENT SYSTEM; AND FACTORY-LEVEL MAINTENANCE FOR ALL UNITS SHALL BE PROVIDED DURING THE TRAINING PERIOD AND FOR THE PERIOD OF OPERATION OF THE PROJECT. 0D F

LEUPOLD AND STEVENS, INC., P.O. BOX 688, BEAVERTON, OREGON 97005

\$50,475.75

TO BE COMPLETED BY 1 FEB 80.

DOT-HS-8-02060

#### **MATERIAL DEVELOPMENT: TRAINING OF PERSONNEL FOR VEHICLE TITLING AND REGISTRATION**

A TRAINING PACKAGE TO INSTRUCT MANAGEMENT, SUPERVISION, AND OPERATIONS CONCEPTS TO STATE MOTOR VEHICLE TITLING AND REGISTRATION SPECIALISTS, SHALL BE DEVELOPED, TESTED, AND EVALUATED. 0 AN

DUNLAP AND ASSOCIATES, INC., ONE PARKLAND DRIVE, DARIEN, CONNECTICUT 06820

\$65,258.00

TO BE COMPLETED FIFTEEN (15) MONTHS FROM DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02061

#### **STATE REHABILITATION PROGRAM EVALUATION STUDY**

THE EFFECTIVENESS OF THE DWI (DRIVING WHILE INTOXICATED) REFERRAL PROGRAM OF THE CITY OF RICHMOND (VIRGINIA) ALCOHOL SAFETY ACTION PROJECT (ASAP) SHALL BE EVALUATED. 0N S

CITY OF RICHMOND ASAP, 2325 WEST BROAD STREET, RICHMOND, VIRGINIA

\$97,395.43

TO BE COMPLETED THIRTY-THREE (33) MONTHS FROM DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02062

#### **PRESENTING SAFETY INFORMATION TO TRAFFIC VIOLATORS**

AN EFFECTIVE SAFETY INFORMATION DELIVERY SYSTEM FOR TRAFFIC VIOLATORS SHALL BE DEVELOPED. THE SAFETY INFORMATION PROGRAM WILL UTILIZE MATERIAL SPECIFICALLY TAILORED TO THE TRAFFIC VIOLATOR AND FOCUS ON ACCIDENT PREVENTION AND ENERGY CONSERVATION, WILL PROPERLY DELIVER THE INFORMATION TO THE TRAFFIC OFFENDER, AND WILL INSURE A THOROUGH UNDERSTANDING OF THE MATERIAL. THE PROJECT SHALL BE CONDUCTED IN TWO PHASES, THE DESIGN OF THE SYSTEM, AND AN EVALUATION OF THE DESIGNED SYSTEM.

NATIONAL PUBLIC SERVICES RESEARCH INST., 123 NORTH PITT STREET, ALEXANDRIA, VIRGINIA 22314

\$81,815.00

TO BE COMPLETED EIGHTEEN (18) MONTHS FROM DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02065

#### **DATA ANALYSIS AND REPORTING TECHNIQUES (DART) IMPROVEMENT PROGRAM**

A PACKAGE THAT WILL PRODUCE BIVARIATE TABLES FROM DATA SELECTED FROM A STATE'S DART

DOT-HS-6-01467 MOD. 3

(DATA ANALYSIS AND REPORTING TECHNIQUES) TRAFFIC ACCIDENT FILE SHALL BE DEVELOPED. THE PROGRAM WILL PERFORM BASIC STATISTICAL ANALYSIS TO IDENTIFY OVERREPRESENTED POPULATIONS. THE PROGRAM WILL BE COMPATIBLE WITH THE OUTPUT DATA SELECTED BY THE DART QUERIES AND CAN BE OPERATED ON MOST MAJOR COMPUTER SYSTEMS. THE DEVELOPMENT OF THIS PROGRAM WILL SIMPLIFY AND ENCOURAGE THE USE OF THE DART PACKAGE FOR PRACTICAL PROBLEM IDENTIFICATION THROUGH DATA ANALYSIS.

GENASYS CORPORATION, ONE CENTRAL PLAZA,  
11300 ROCKVILLE PIKE, ROCKVILLE, MD 20852  
\$47,493.00  
TO BE COMPLETED NINE (9) MONTHS FROM DATE OF  
CONTRACT AWARD (30 SEP 78).

DOT-HS-6-01467 MOD. 3

#### **CRITICAL TASK INTERLOCK UNITS**

THE FOLLOWING DELIVERABLES EQUIVALENT TO THE SPECIFICATIONS AS REQUIRED IN THE BASIC CONTRACT SHALL BE PROVIDED: TWO (2) CTI (CRITICAL TASK INTERLOCK) UNITS, ONE (1) OF THESE UNITS SUPPLIED WITH A DATA LOGGER, ONE (1) CASSETTE PLAYBACK UNIT, ONE (1) QUICK-LOOK DISPLAY UNIT, ONE (1) TEST JIG, TEN (10) CERTIFIED DIGITAL DATA CASSETTES, TWO (2) OPERATIONS MANUALS, SPARE PARTS (TO INCLUDE A SET OF SPARE CARDS, TWO (2) SETS OF INSTALLATION HARDWARE, ONE (1) POWER SUPPLY, AND ONE (1) DATA LOGGER BATTERY), AND CRATES FOR SHIPMENT OF EQUIPMENT (PREPARATION FOR FOREIGN SHIPMENT). THE FOLLOWING TECHNICAL SERVICES SHALL BE PROVIDED: ONE TRIP OF TEN (10) WORKING DAYS, PLUS TRAVEL TO AND FROM AUSTRALIA, FOR TECHNICAL SERVICES (ASSISTANCE IN THE INSTALLATION OF ONE (1) CTI UNIT IN A VEHICLE SUPPLIED BY THE AUSTRALIANS, INCLUDING ANY NECESSARY MODIFICATIONS; ASSISTANCE IN THE CONNECTION OF ONE LABORATORY UNIT (SELF-CONTAINED); CHECKOUT AND REPAIR OF THE EQUIPMENT INCLUDING INSPECTION AFTER SHIPPING; AND INSTRUCTION ON EQUIPMENT USAGE, ADJUSTMENTS, ETC.); CONSULTATION AND MAINTENANCE, AS NEEDED, AFTER DELIVERY AND SET-UP OF EQUIPMENT; AND REPAIRS TO REPLACE DEFECTIVE PARTS TO EQUIPMENT AND CORRECTION OF ANY AND ALL MALFUNCTIONS THERETO FOR A PERIOD OF NINETY (90) DAYS AFTER EQUIPMENT INSTALLATION. 0LY

SYSTEMS TECHNOLOGY, INCORPORATED, 13766  
SOUTH HAWTHORNE BLVD., HAWTHORNE,  
CALIFORNIA 90250  
INCREASED \$52,213.00  
TO BE COMPLETED BY 31 AUG 79.

HSL 78-08

DOT-HS-6-01512 MOD. 5

#### **MULTIDISCIPLINARY HIGHWAY COLLISION INVESTIGATION TRAINING COURSE**

ONE COURSE FOR THE TRAINING OF ACCIDENT INVESTIGATION AND ALLIED SPECIALISTS SHALL BE ARRANGED, CONDUCTED, AND REPORTED. THE COURSE CURRICULUM PREVIOUSLY DEVELOPED, MULTIDISCIPLINARY HIGHWAY COLLISION INVESTIGATION TRAINING COURSE, WILL BE USED TO CONDUCT THE ADDITIONAL COURSE. APPROXIMATELY 30 STUDENTS WILL BE TRAINED. 0 OP

DYNAMIC SCIENCE, INC., 1850 WEST PINNACLE PEAK  
ROAD, PHOENIX, ARIZONA 85027  
INCREASED \$24,857.00  
TO BE COMPLETED BY JUN 79.

DOT-HS-7-01784 MOD. 3

#### **CORPORATE STRATEGIES OF AUTOMOTIVE MANUFACTURERS**

THE REQUIREMENT TO DELIVER A FINAL REPORT IS DELETED AND AN EXPANDED SUMMARY REPORT SHALL BE SUBSTITUTED. SPECIFICALLY, THE ANALYSIS TO BE PROVIDED INCLUDES THE FOLLOWING: A REVISED, EXPANDED SUMMARY OF ALL WORK (TO INCLUDE A DETAILED EXPLANATION OF THE METHODOLOGICAL TOOLS EMPLOYED IN THE ANALYSIS OF AUTOMOBILE COMPANY STRATEGIES, A DISCUSSION OF THE RELATIONSHIP BETWEEN THE STRATEGY CHOSEN AND THE MANUFACTURER'S ABILITY TO IMPLEMENT THIS STRATEGY, AND A DISCUSSION OF THE EFFECTS OF A MINOR RECESSION); AND A COMPLETE REVISION OF ALL SUPPORT DOCUMENTS. THE SUMMARY AND SUPPORT DOCUMENTS WILL BE SUPPORTED BY EXTENSIVE DOCUMENTATION, CITATIONS, AND REFERENCES. 0EL

THE FUTURES GROUP, INC., 124 HEBRON AVENUE,  
GLASTONBURY, CONNECTICUT 06033  
INCREASED \$19,000.00  
TO BE COMPLETED BY 15 NOV 78.

DOT-HS-7-01789 MOD. 3

#### **AUGMENTATION OF RESEARCH AND ANALYSIS CAPABILITIES FOR TIMELY SUPPORT OF AUTOMOTIVE FUEL ECONOMY ACTIVITIES**

IN AN EFFORT TO ASSESS THE EFFECTS OF WEIGHT OF FMVSS NO. 208, OCCUPANT CRASH PROTECTION, ON THE MANUFACTURER'S ABILITY TO MEET EXISTING AND FUTURE FUEL ECONOMY STANDARDS, A PROTOTYPE PASSIVE RESTRAINT SYSTEM OBTAINED FROM A DOMESTIC MANUFACTURER WHICH WILL BEGIN TO APPEAR IN PRODUCTION IN SEVERAL YEARS SHALL BE "TORN DOWN" TO THE COMPONENT LEVEL. THE COMPONENTS AND COMPONENT ASSEMBLY OPERATIONS THAT MAKE UP THE EQUIPMENT SYSTEMS SHALL BE IDENTIFIED IN DETAIL. ALSO, THE COMPONENTS DESIGN SPECIFI-

August 31, 1978

DOT-HS-8-02024

CATION LEVELS RELATIVE TO MEETING OR EXCEEDING REQUIRED STANDARD PERFORMANCE LEVELS SHALL BE DESCRIBED. THE MATERIAL TYPES, MATERIAL SPECIFICATION, PROCESSING METHODS, MATERIAL WEIGHTS, AND LABOR MINUTES FOR ASSEMBLY OPERATIONS IN EACH OF THE ELEMENTS IN EACH OF THE COMPONENTS THAT MAKE UP THE DESIGN CONCEPTS THAT SATISFY THE STANDARD, SHALL BE IDENTIFIED. SKETCHES SHALL BE PROVIDED FOR THE COMPONENTS; FULL-SIZE, CUT-AWAY COLOR SKETCHES OF THE MAJOR COMPONENTS THAT MAKE UP THE SYSTEMS WILL BE INCLUDED, MOUNTED ON HARD CARDBOARD.

CORPORATE-TECH PLANNING, INC., 275 WYMAN STREET, WALTHAM, MASSACHUSETTS 02154  
INCREASED \$19,689.00  
TO BE COMPLETED TWO (2) MONTHS FROM DATE OF CONTRACT AWARD (30 SEP 78).

DOT-HS-8-01984 MOD. 1

#### **COMFORT AND CONVENIENCE OF SAFETY BELTS IN 1979 MODEL CARS**

THE NUMBER OF SUBJECTS TO BE USED IN EVALUATING SAFETY BELT SYSTEMS SHALL BE INCREASED FROM SEVENTY-FIVE (75) TO ONE HUNDRED AND TWENTY (120). THE ADDITIONAL SUBJECTS ARE NEEDED TO PROVIDE ADEQUATE ANTHROPOMETRIC AND DEMOGRAPHIC SUBJECT REPRESENTATION. 00 T

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."  
INCREASED \$19,978.00  
EXTENDED TO 31 OCT 78

DOT-HS-8-01987

#### **ANALYSIS OF REPAIR RECEIPTS IN RESPONSE TO DIAGNOSTIC INSPECTION**

IN CONJUNCTION WITH THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S (NHTSA) DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT, DATA FROM INITIAL INSPECTION AND REINSPECTION, REPAIR INVOICES, AND OWNER INTERVIEWS COLLECTED IN DIAGNOSTIC CENTERS IN HUNTSVILLE, ALA.; CHATTANOOGA, TENN.; PHOENIX, ARIZ.; TUCSON, ARIZ.; AND WASHINGTON, D.C. SHALL BE ANALYZED TO DETERMINE THE INCIDENCE, CAUSES, AND LOSSES DUE TO UNNEEDED REPAIR. THE FOLLOWING WORK SHALL BE PERFORMED IN THIS EFFORT: PERFORM SYSTEMS ANALYSIS OF CONSUMER LOSSES IN AUTO REPAIR; DEVELOP STRATEGY TO ANALYZE THE DIAGNOSTIC DEMONSTRATION DATA IN ACCORDANCE WITH THE SYSTEMS ANALYSIS; DEVELOP STRATEGY FOR DRAWING A PROBABILITY SAMPLE OF THE DATA

AND PERFORM CODING AND AUTOMATION; DEVELOP STATISTICALLY VALID STRATEGY FOR QUALITY CONTROL OF THE CASE ANALYSES AND ENCODING; PRETEST DATA REDUCTION AND QUALITY CONTROL STRATEGIES; PERFORM DATA REDUCTION, AUTOMATION, AND QUALITY CONTROL ON A PROBABILITY SAMPLE OF CASES; PERFORM ANALYSES; AND ASSESS BIASES IN THE ANALYSES DUE TO THE AVAILABILITY OF DIAGNOSTIC INFORMATION. 0AKE

THE CENTER FOR THE ENVIRONMENT AND MAN, INC., 275 WINDSOR STREET, HARTFORD, CONNECTICUT 06120  
\$102,800.00  
INDEFINITE

DOT-HS-8-02023

#### **NATIONAL ANALYSIS OF UNSAFE DRIVING ACTIONS AND BEHAVIORAL ERROR IN DRIVING**

THE UNSAFE DRIVING ACTIONS (UDA'S) IDENTIFIED IN DOT-HS-5-01259 SHALL BE VALIDATED IN TERMS OF THEIR CAUSAL ASSOCIATION TO SEVERE/FATAL ACCIDENTS; THESE UDA'S AND THE CRASHES TO WHICH THEY LEAD SHALL BE MORE FULLY DEFINED, IN A MANNER USEFUL FOR COUNTERMEASURE IDENTIFICATION AND DEVELOPMENT; AND ROADSIDE OBSERVATION PROCEDURES FOR

WIDE  
TRAFFIC, AND

THE REGENTS OF THE UNIVERSITY OF MICHIGAN, 260 RESEARCH ADMINISTRATION BUILDING, ANN ARBOR, MICHIGAN 48109  
\$302,575.00  
TO BE COMPLETED IN TWO (2) YEARS.

DOT-HS-8-02024

#### **THE INCIDENCE OF DRUGS AMONG FATALLY INJURED DRIVERS**

AN INDICATION OF THE NATIONAL INCIDENCE OF DRUGS OTHER THAN ALCOHOL (E.G. MARIHUANA) AND DRUG GROUPS (E.G. BARBITURATES) IN HIGHWAY FATALITIES SHALL BE DETERMINED BY STUDYING A NATIONALLY REPRESENTATIVE SAMPLE OF DECEASED DRIVERS; URBAN, RURAL, AND REGIONAL (GEOGRAPHIC) DIFFERENCES CONCERNING DRUG PRESENCE AMONG THESE FATALITIES SHALL BE IDENTIFIED; AND IF FEASIBLE AND PRACTICAL, THE INCIDENCE AND LEVELS OF DRUGS IN

DOT-HS-8-02028

LIVING DRIVERS INVOLVED IN AUTO ACCIDENTS SHALL BE DETERMINED. MIT

THE REGENTS OF THE UNIVERSITY OF MICHIGAN,  
260 RESEARCH ADMINISTRATION BUILDING, ANN  
ARBOR, MICHIGAN 48109  
\$843,045.00  
TO BE COMPLETED IN TWENTY-EIGHT (28) MONTHS.

DOT-HS-8-02028

#### **RURAL EMERGENCY MEDICAL SERVICES SYSTEM PROJECT STUDY**

A RURAL EMERGENCY MEDICAL SERVICE (EMS) SYSTEM ANALYTICAL COMPUTER MODEL AND PLANS FOR A FUTURE EFFORT TO FIELD TEST THE MODEL TO EVALUATE ITS PREDICTIVE ACCURACY SHALL BE DEVELOPED. THE STUDY WILL ANALYZE RURAL EMS NEEDS AND DEVELOP A COMPUTER MODEL WHICH WILL INCLUDE CONSIDERATION OF ATTAINABLE STATE-OF-THE-ART SOLUTIONS. THE MODEL WILL CONSIDER INNOVATIVE APPLICATIONS OF AVAILABLE RESOURCES WITHIN THE RURAL COMMUNITY TO PROVIDE THE BEST POSSIBLE CARE IN THE SHORTEST POSSIBLE TIME TO A VICTIM OF A TRAUMATIC ACCIDENT IN A RURAL AREA. THE MODEL WILL PERMIT SIMULATION OF A DEMONSTRATION PROJECT TO EVALUATE A VARIETY OF COUNTERMEASURES WHICH ARE APPLICABLE TO A RURAL EMS, AND PROVIDE MEANS FOR EVALUATING THE COSTS AND EFFECTIVENESS OF THE COUNTERMEASURES. THE MODEL IS TO INCLUDE CONSIDERATION OF THE COUNTERMEASURES SINGLY AND IN COMBINATION AND TO PERMIT CONSIDERATION OF ADDITIONAL COUNTERMEASURES THAT MAY EVOLVE IN THE FUTURE. 0SES

UNIVERSITY OF PITTSBURGH, OFFICE OF  
RESEARCH, 3500 VICTORIA STREET, PITTSBURGH,  
PENNSYLVANIA 15261  
\$184,573.00  
TO BE COMPLETED TWELVE (12) MONTHS FROM  
DATE OF CONTRACT AWARD (22 SEP 78).

DOT-HS-8-02033

#### **MOPED TASK ANALYSIS**

THIS MOPED TASK ANALYSIS SHALL ACCOMPLISH THE FOLLOWING: IDENTIFY THE BEHAVIOR, KNOWLEDGE, AND SKILLS THAT ARE REQUIRED TO SAFELY OPERATE A MOPED, AND THAT ARE DIFFERENT FROM THOSE INVOLVED IN THE OPERATION OF OTHER TWO-WHEELED VEHICLES; IDENTIFY INSTRUCTIONAL OBJECTIVES FOR MOPED SAFETY EDUCATION AND FORMULATE RECOMMENDATIONS FOR NEW PROGRAM DEVELOPMENT OR MODIFICATION OF EXISTING EDUCATIONAL MATERIALS SUCH AS THE MOTORCYCLE RIDER COURSE DEVELOPED BY THE MOTORCYCLE SAFETY FOUNDATION OR THE BICYCLE SAFETY COURSE DEVELOPED BY THE CALIFORNIA DEPT. OF EDUCATION; AND IDENTIFY PERFORMANCE TESTING STANDARDS FOR EDUCATIONAL PROGRAMS AND POSSIBLE USE IN ESTABLISHING LICENSING CRITERIA.

HSL 78-08

DARDS FOR EDUCATIONAL PROGRAMS AND POSSIBLE USE IN ESTABLISHING LICENSING CRITERIA.

NATIONAL PUBLIC SERVICE RESEARCH INSTITUTE,  
123 N. PITT STREET, ALEXANDRIA, VIRGINIA 22314  
\$112,666.00  
TO BE COMPLETED TWELVE (12) MONTHS FROM  
DATE OF CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02039

#### **EXTENSION OF FMVSS NO. 218 TO COVER ALL HELMET SIZES**

DURING PHASE 1, TEST HEADFORM SIZES A, C, AND D SHALL BE FABRICATED FOR USE IN COMPLIANCE TESTING OF MOTORCYCLE HELMETS; AND DURING PHASE 2, COMPLIANCE TEST PROCEDURES SHALL BE DEVELOPED TO USE THE PROTOTYPE HEADFORMS FABRICATED IN PHASE 1 WHICH WILL EXTEND THE CURRENT FMVSS NO. 218 TO COVER SMALL AND EXTRA-LARGE HELMETS. CURRENTLY, THE STANDARD APPLIES ONLY TO HELMETS THAT FIT THE SIZE C TEST HEADFORM D B

DAYTON T. BROWN, INC., ENGINEERING AND TEST  
DIVISION, CHURCH STREET, BOHEMIA, LONG  
ISLAND, NEW YORK 11716  
\$93,886.00  
TO BE COMPLETED TEN (10) MONTHS FROM DATE OF  
CONTRACT AWARD (29 SEP 78).

DOT-HS-8-02046

#### **SYMPOSIUM ON COMMERCIAL TRUCKS - EXPOSURE ESTIMATES**

A THREE-DAY SYMPOSIUM ON COMMERCIAL TRUCKS EXPOSURE ESTIMATION TECHNIQUES, TO BE HELD IN WASHINGTON, D.C. IN THE NEAR FUTURE, SHALL BE COORDINATED. ALL NECESSARY ACTIVITIES FOR SUCCESSFUL COMPLETION OF SUCH A NATIONAL SYMPOSIUM (CO-SPONSORED BY THE DEPT. OF TRANSPORTATION (DOT), NATIONAL HWY. TRAFFIC SAFETY ADMINISTRATION (NHTSA), AND FEDERAL HWY. ADMINISTRATION (FHWA)) SHALL BE COORDINATED TO BE IN FULL CONSONANCE WITH THE FOLLOWING OVERALL PURPOSES: IDENTIFY THE CURRENT STATUS OF COMMERCIAL VEHICLE EXPOSURE ESTIMATION; DEFINE NEW TECHNIQUES OR METHODOLOGIES TO SIGNIFICANTLY IMPROVE COMMERCIAL VEHICLE EXPOSURE ESTIMATION; AND DESCRIBE NEW NATIONAL, STATE OR LOCAL PROGRAMS, OR ACTIVITIES, FOR IMPLEMENTATION THAT WOULD YIELD IMPROVED COMMERCIAL VEHICLE EXPOSURE DATA ACQUISITION. 0HE

THE INSTITUTE FOR SAFETY ANALYSIS, 6400  
GOLDSBORO ROAD, WASHINGTON, D.C. 20034  
\$26,109.00  
TO BE COMPLETED NINE (9) MONTHS FROM DATE OF  
CONTRACT AWARD (29 SEP 78).

August 31, 1978

DOT-HS-6-01478 MOD. 11

DOT-HS-020-2-290 IA MOD. 6

**DEVELOPMENT OF STANDARDS FOR BREATH TESTING EQUIPMENT**

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) STANDARDS FOR BREATH ALCOHOL TESTING DEVICES SHALL BE FORMULATED, AND TECHNICAL SUPPORT SHALL BE PROVIDED TO NHTSA DURING THE QUALIFICATION TESTING OF THE BREATH TESTING DEVICES.

NATIONAL BUREAU OF STANDARDS, LAW ENFORCEMENT STANDARDS LABORATORY, WASHINGTON, D.C. 20034  
\$82,500.00  
EXTENDED TO 30 SEP 78

DOT-HS-5-01060 TASK ORDER 16

**FATAL ACCIDENT FILE, SOURCE DOCUMENT DATA CONVERSION**

SOURCE DOCUMENT DATA FOR THE FATAL ACCIDENT REPORTING SYSTEM (FARS) SHALL BE CONVERTED FOR AUTOMATIC RETRIEVAL. OCHN

INSTITUTE OF MODERN PROCEDURES, 1025 VERMONT AVENUE, N.W., SUITE 306, WASHINGTON, D.C. 20005  
\$58,183.78  
TO BE COMPLETED BY 1 OCT 78.

DOT-HS-5-01063 TASK ORDER 11

**IMPACT PROGRAM IMPROVEMENTS**

A NUMBER OF IMPROVEMENTS SHALL BE DEVELOPED FOR AND CODED IN THE IMPACT COMPUTER PROGRAM THAT WILL EXTEND ITS USEFULNESS TO VIRTUALLY ALL TYPES OF VEHICLE-TO-VEHICLE COLLISIONS. THE COMPUTER ROUTINE SHALL BE WRITTEN IN FORTRAN USING A TIME-SHARING CDC CYBERNET SYSTEM.

OPPORTUNITY SYSTEMS, INC., 1406 L STREET, N.W., WASHINGTON, D.C. 20005  
\$18,999.00  
TO BE COMPLETED BY 12 AUG 78.

DOT-HS-5-01063 TASK ORDER 12

**CODING AND EDITING SUPPORT FOR THE NATIONAL DRIVER REGISTER**

CODING AND EDITING SERVICES SHALL BE PROVIDED FOR THE MAINTENANCE OF THE NATIONAL DRIVER REGISTER (NDR) OPERATING FILES. THESE SERVICES SHALL INCLUDE ERROR ANALYSIS, CORRECTION OF RECORDS, DATA CONVERSION MONI-

TORING AND ASSOCIATED COMPUTER INPUT DATA PREPARATION.

OPPORTUNITY SYSTEMS, INC., 1406 L STREET, N.W., WASHINGTON, D.C. 20005  
\$83,600.00  
TO BE COMPLETED BY 28 JAN 79.

DOT-HS-6-01466 MOD. 1

**PUBLIC ACCEPTABILITY OF HIGHWAY SAFETY COUNTERMEASURES**

TASK 2 (PREPARATION FOR DATA COLLECTION) AND ALL SUBSEQUENT TASKS SHALL BE PERFORMED. THE PUBLIC SURVEY WILL INVOLVE A SPLIT SAMPLE OF 1,500 RESPONDENTS IN ORDER TO OBTAIN ADEQUATE DATA ON PUBLIC REACTION TO ALL OF THE HIGHWAY SAFETY COUNTERMEASURES.

MATHEMATICA POLICY RESEARCH, INC., P.O. BOX 2393, PRINCETON, NEW JERSEY 08540  
INCREASED \$62,349.00  
EXTENDED TO 31 JAN 79.

DOT-HS-6-01478 MOD. 11

**STANDARD ENFORCEMENT TESTING PROGRAM TESTING OF PASSENGER VEHICLES FOR COMPLIANCE WITH FMVSS NOS. 219 AND 301-75**

IN TESTING PASSENGER VEHICLES FOR COMPLIANCE WITH FMVSS NOS. 219 AND 301-75, AV'S (AVERAGES) SHALL BE PROVIDED FOR ALL 27 FMVSS 301-75 IMPACT TESTS; AV'S FOR THE 35 FMVSS 301-75 TESTS TO BE PERFORMED FOR THE 1978 TESTING SHALL BE COMPUTED. TRAJECTORY EVIDENCE WILL BE PRESENTED ON A SCALED DIAGRAM, IDENTIFYING THE COORDINATE AXES AND REFERENCE ORIGIN, THE VEHICLE POSITIONS AT IMPACT, FINAL REST, AND END OF ROTATIONAL AND/OR LATERAL SKIDDING, POINT ON CURVE FOR CURVED PATH SPINOUTS, AND IDENTIFYING TRACES OF THE TIRE TRACKS OF EACH VEHICLE. RESIDUAL CRUSH ON EACH VEHICLE WILL BE DOCUMENTED WITH PHOTOGRAPHS, BY THE SAE J224A COLLISION DEFORMATION CLASSIFICATION, AND WITH DAMAGE PROFILES FOR EACH VEHICLE. ADDITIONAL INFORMATION SHALL BE DOCUMENTED AS FOLLOWS: TIRE-GROUND COEFFICIENT OF FRICTION, VEHICLE MAKE/MODELS AND MASSES, ACCELEROMETER TRACES, IMPACT SPEEDS, STEERING AND BRAKING INPUTS, AND ESTIMATES OF THE ROAD TO CLEARANCE OF EACH TIRE. INC

DYNAMIC SCIENCE, INC., 1850 WEST PINNACLE PEAK ROAD, PHOENIX, ARIZONA 85027  
INCREASED \$12,547.00  
TASK 1 TO BE COMPLETED FOUR (4) WEEKS FROM DATE OF MODIFICATION AWARD (9 MAY 78); NO CHANGE FOR TASKS 2-4.

DOT-HS-6-01483 MOD. 3

**IMPACT OF MOTORCYCLE HELMET USAGE IN OKLAHOMA**

STATISTICAL ANALYSES SHALL BE CONDUCTED WHICH WILL BE ORIENTED TOWARD DETERMINING THE RELATIONSHIP BETWEEN THE MOTORCYCLE ACCIDENT INJURY SEVERITY AND THE USAGE OF THE MOTORCYCLE HELMET. THIS SHALL INCLUDE BUT NOT BE LIMITED TO EVALUATING THE FOLLOWING ELEMENTS: THE EFFECT OF THE HELMET LAW REPEAL ON THE USAGE OF MOTORCYCLE HELMETS IN THE STATE OF OKLAHOMA, THE FREQUENCY AND SEVERITY OF THE INJURIES SUFFERED WITH AND WITHOUT HELMETS, THE DISTRIBUTION OF FATAL INJURIES BY BODY AREA WITH AND WITHOUT HELMETS, AND THE EFFECTIVENESS (IF ANY) OF THE HELMET IN REDUCING THE NUMBER AND/OR SEVERITY OF HEAD INJURIES. 0 AN

STATE OF OKLAHOMA, HIGHWAY SAFETY OFFICE,  
G-80 JIM THORPE BUILDING, OKLAHOMA CITY,  
OKLAHOMA 73105  
INCREASED \$2,876.50  
EXTENDED TO 10 MAY 78

DOT-HS-7-01579 MOD. 1

**PEDESTRIAN INJURY CAUSATION PARAMETERS**

FIELD FORMS, DATA QUALITY CONTROL, DATA AUTOMATION AND ANALYSIS SHALL BE PROVIDED FOR 700 ADDITIONAL PEDESTRIAN ACCIDENT CASES. P B

CALSPAN CORPORATION, POST OFFICE BOX 235,  
BUFFALO, NEW YORK 14221  
INCREASED \$32,431.00  
EXTENDED FOUR (4) MONTHS

DOT-HS-7-01643 MOD. 2

**DEVELOPMENT AND APPLICATION OF ANALYTICAL AND STATISTICAL METHODS IN VEHICLE STRUCTURES RESEARCH II**

IN THE DEVELOPMENT AND APPLICATION OF ANALYTICAL AND STATISTICAL METHODS IN VEHICLES STRUCTURES RESEARCH, THE FOLLOWING TASKS SHALL BE PERFORMED: COMPLETE THE ROLL-OVER SIMULATION WORK BY STUDYING THE EFFECTS OF VARYING SIGNIFICANT VEHICLE AND TEST DEVICE PROPERTIES (AS A MINIMUM, TO INCLUDE THE EFFECT OF POSITIONING VEHICLES ON THE ROLLOVER CART AT VARIOUS ROLL AND YAW ANGLES, THE EFFECTS OF CART SNUBBING DECELERATION PULSE VARIATIONS, THE EFFECTS OF VEHICLE DIMENSIONAL AND INERTIAL CHARACTERISTICS, AND THE EFFECTS OF VARYING VEHICLE SUSPENSION PROPERTIES); PROVIDE THE PROGRAMMING SUPPORT NECESSARY TO COMPLETE THE DATA BASE MANAGEMENT SYSTEM AND PROVIDE SOFTWARE MAINTENANCE SUPPORT TO ENABLE EFFICIENT AND RELIABLE UTILIZATION OF THE COMPUTER EQUIPMENT; AND RETRIEVE

DYNAMIC CRASH TEST DATA FROM CALSPAN AND DYNAMIC SCIENCE FOR PREVIOUSLY COMPLETED TESTING AND ENTER THESE DATA INTO THE DATA BASE. 0 MO

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."  
INCREASED \$49,582.00  
NO CHANGE

DOT-HS-7-01708 MOD. 3

**SUPPORT FOR ANALYTICAL TOOLS FOR AUTOMOTIVE FUEL ECONOMY ACTIVITIES**

ADDITIONAL SUPPORT FOR ANALYTICAL TOOLS SHALL BE PROVIDED TO THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) AUTOMOTIVE FUEL ECONOMY ACTIVITIES. 00RM

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."  
INCREASED \$49,904.00  
EXTENDED TO 15 DEC 78

DOT-HS-7-01736 MOD. 3

**SAFETY BELT USAGE IN THE TRAFFIC POPULATION**

SAFETY BELT USAGE DATA SHALL BE COLLECTED AS FOLLOWS: COLLECT DATA AT TURNPIKE TICKET TOLL BOOTHS ON THE NEW JERSEY, PENNSYLVANIA AND FLORIDA TURNPIKES (FOUR (4) HOURS PER MONTH FOR SIX (6) MONTHS ON EACH TURNPIKE, OBSERVATIONS EQUALLY DIVIDED BETWEEN DAY AND NIGHTTIME PERIODS), AND COLLECT DATA IN RURAL AREAS (UP TO 50 MILES FROM THE CITY) FOR EACH OF THIS STUDY'S 19 CITIES FOR ONE (1) DAY PER MONTH FOR SIX (6) MONTHS.0FFE

OPINION RESEARCH CORPORATION, NORTH HARRISON STREET, PRINCETON, NEW JERSEY 08540  
INCREASED \$23,959.00  
NO CHANGE

DOT-HS-7-01789 MOD. 1

**AUGMENTATION OF RESEARCH AND ANALYSIS CAPABILITIES FOR TIMELY SUPPORT OF AUTOMOTIVE FUEL ECONOMY ACTIVITIES**

THE IMPACT OF SUBSTITUTING COMPOSITE MATERIALS FOR STEEL IN LIGHT-DUTY VEHICLES (LDV) IN THE 1985-1990 TIME PERIOD SHALL BE EVALUATED



August 31, 1978

DOT-HS-8-01944

IN TERMS OF WEIGHT REDUCTION POTENTIALS, MANUFACTURING PROCESSES, CAPITAL INVESTMENTS AND CONSUMER COSTS, MATERIALS AVAILABILITY, AND POTENTIAL ENVIRONMENTAL CONCERNS

CORPORATE-TECH PLANNING, INC., 275 WYMAN STREET, WALTHAM, MASSACHUSETTS 02154  
INCREASED \$24,907.00  
TO BE COMPLETED BY 17 JUL 78.

DOT-HS-7-01798 MOD. 1

#### REGIONAL WORKSHOPS ON BICYCLE SAFETY

PERSONALIZED LETTERS SHALL BE SENT TO EACH INVITEE ADDED TO THE PROFESSIONAL IMAGE OF THE REGIONAL WORKSHOPS ON BICYCLE SAFETY; AND AN ATTEMPT SHALL BE MADE TO INCREASE THE RESPONSE RATE TO HELP ASSURE A BALANCED, WELL ATTENDED WORKSHOP SERIES PRO

URBAN SCIENTIFIC AND EDUCATIONAL RESEARCH, INC., POST OFFICE BOX 19112, 20TH STREET STATION, WASHINGTON, D.C. 20036  
INCREASED \$2,605.00  
NO CHANGE

DOT-HS-8-01929

#### FURTHER DEVELOPMENT IN THE THORAX PROGRAM

THE THORAX COMPUTER PROGRAM FOR SIMULATION OF HUMAN THORACIC SKELETAL RESPONSE AND RIB FRACTURE SHALL BE FURTHER DEVELOPED TO MEET THE FOLLOWING OBJECTIVES: TO IMPROVE USER CONVENIENCE OF THE PROGRAM PARTICULARLY FOR CHANGING THORACIC GEOMETRY, TO INCORPORATE CAPABILITIES ULTIMATELY PERMITTING SIMULATION OF THORACIC IMPACT WITH DEFORMABLE VEHICULAR OR RESTRAINT SYSTEM STRUCTURES, TO VALIDATE ESSENTIAL FEATURES OF THE THORAX-STRUCTURE INTERACTION WITHIN THE EXTENT OF AVAILABLE EXPERIMENTAL DATA, TO INCORPORATE SPECIFIED CAPABILITIES IN THE PROGRAM TO GIVE RAPID PREDICTION OF SELECTED CASES OF CRASH ENVIRONMENT, AND TO INCORPORATE LIMITED CAPABILITY TO PREDICT INJURY LEVEL THROUGH ABBREVIATED INJURY SCALE CONCEPTS. OPEN

THE FRANKLIN INSTITUTE, 20TH AND THE PARKWAY, PHILADELPHIA, PENNSYLVANIA  
\$153,453.00  
TO BE COMPLETED TWELVE (12) MONTHS FROM DATE OF CONTRACT AWARD (9 MAY 78).

DOT-HS-8-01931

#### FMVSS NO. 206 "DOOR LOCKS AND DOOR RETENTION COMPONENTS"

FIFTY (50) SETS OF HATCHBACK OR TAILGATE HINGES AND FIFTY (50) SETS OF LATCHES AND STRIKERS FROM NEW OR REPLACEMENT PART SOURCES AS AVAILABLE FROM TWENTY-FIVE (25) DIFFERENT HATCHBACK OR TAILGATE VEHICLES (TO INCLUDE VARIOUS SELECTED VEHICLE MODELS) SHALL BE PURCHASED AND TESTED IN ACCORDANCE WITH FMVSS NO. 206, DOOR LOCKS AND DOOR RETENTION COMPONENTS. THE HINGES, LATCHES AND STRIKERS SHALL BE TESTED AS ONE TEST CONSISTING OF THE FOLLOWING SUBTESTS (SECTION I.A, 1, 2, 4, AND 6 OF THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S (NHTSA) LABORATORY TEST PROCEDURE TP-206-02 DATED NOVEMBER 1973): HINGE LONGITUDINAL LOAD; HINGE TRANSVERSE LOAD; LATCH AND STRIKER LONGITUDINAL LOAD, FULLY LATCHED; AND LATCH AND STRIKER TRANSVERSE LOAD, FULLY LATCHED.

APPROVED ENGINEERING TEST LABORATORY, 1536 EAST VALENCIA DRIVE, FULLERTON, CALIFORNIA 92631  
\$15,625.00  
TO BE COMPLETED FORTY-FIVE (45) DAYS FROM DATE OF CONTRACT AWARD (10 MAY 78).

DOT-HS-8-01933

#### TEST DEVICE AND TEST PROCEDURE TO ASSESS SIDE STRUCTURES

A RESEARCH EFFORT SHALL BE UNDERTAKEN TO DESIGN, DEVELOP, AND TEST AN IMPACTOR (A MOVING BARRIER) AND TEST PROCEDURES FOR MEASURING AND EVALUATING THE CAPABILITIES OF VEHICLE SIDE STRUCTURES AND WHICH ARE SUITABLE FOR APPLICATION TO BOTH RESEARCH TESTING AND TESTING FOR COMPLIANCE WITH FEDERAL MOTOR VEHICLE SAFETY STANDARDS.

DYNAMIC SCIENCE, INC., 1850 PINNACLE PEAK RD., PHOENIX, ARIZONA 85027  
\$562,841.00  
TO BE COMPLETED TWENTY-TWO (22) MONTHS FROM DATE OF CONTRACT AWARD.

DOT-HS-8-01944

#### STATISTICAL ANALYSIS OF NATIONAL CRASH SEVERITY STUDY DATA

THE FOLLOWING STATISTICAL STUDIES SHALL BE PERFORMED FOR THE NATIONAL CENTER FOR STATISTICS AND ANALYSIS' (NCSA) NATIONAL CRASH SEVERITY STUDY (NCSS): PERFORM STATISTICAL ANALYSES OF NCSS DATA TO DETERMINE THE PRINCIPAL GENERAL INJURY MECHANISMS AND THE ACCIDENT CONDITIONS ASSOCIATED WITH THEM; PERFORM CLINICAL ANALYSES OF NCSS DATA TO IDENTIFY SPECIFIC INJURY MECHANISMS

DOT-HS-8-01953

AND IDENTIFY OR DEFINE VARIABLES USEFUL IN DESCRIBING THEM; DEVELOP AND PROGRAM STATISTICAL MODELS TO PREDICT THE PROBABILITY OF SPECIFIC INJURIES AS A FUNCTION OF CRASH CONDITIONS; PRODUCE A FACTBOOK OF CRASH PHASE ACCIDENT STATISTICS FROM THE NCSS DATA; AND USE NCSS DATA TO REVIEW AND CRITIQUE EXISTING ACCIDENT ANALYSIS MODELS.

THE REGENTS OF THE UNIVERSITY OF MICHIGAN,  
260 RESEARCH ADMIN. BLDG., ANN ARBOR, MICH.  
48109

\$385,960.00

TO BE COMPLETED TWENTY-FOUR (24) MONTHS  
FROM DATE OF CONTRACT AWARD (9 MAY 78).

DOT-HS-8-01953

#### **SURVEY OF PRIVATE CITIZENS TO OBTAIN INFORMATION ON PASSIVE RESTRAINT SYSTEMS**

A SCIENTIFIC, NATIONWIDE SURVEY SHALL BE CONDUCTED TO OBTAIN INFORMATION ON PUBLIC ATTITUDES REGARDING PASSIVE RESTRAINT SYSTEMS IN PASSENGER CARS. TWO OBJECTIVES OF THIS PROGRAM ARE TO EDUCATE THE PUBLIC ON THE TECHNOLOGY AND BENEFITS OF PASSIVE RESTRAINT SYSTEMS, AND TO ACQUAINT THE MANUFACTURERS WITH THE PREFERENCES OF THE PUBLIC REGARDING THE TYPES AND DESIGNS OF THESE SYSTEMS.

PETER D. HART RESEARCH ASSOC., INC., 1529 "O"  
STREET, N.W., WASHINGTON, D.C. 20005

\$55,082.00

TO BE COMPLETED BY 17 JUL 78.

DOT-HS-8-01964

#### **RECALL CAMPAIGN MAIL AUDITS**

THE PREPARATION AND MAILING OF FORMS/LETTERS FOR RECALL CAMPAIGN AUDITS SHALL BE ACCOMPLISHED.

CONTROL DATA CORPORATION, 6003 EXECUTIVE  
BOULEVARD, ROCKVILLE, MONTGOMERY,  
MARYLAND 20852

\$48,974.00

TO BE COMPLETED ONE (1) YEAR FROM DATE OF  
CONTRACT AWARD (16 MAY 78).

DOT-HS-8-01951

#### **FIELD TESTING OF TIRES, "SLIDE COEFFICIENT TEST"**

ONE HUNDRED (100) TIRES IN DUPLICATE (TOTAL 200 TIRES) SHALL BE TESTED FOR TRACTION AT THE DEPARTMENT OF TRANSPORTATION TEST FACILITY (UTQG CENTER) AT SAN ANGELO, TEXAS. THE TESTS SHALL BE PERFORMED ACCORDING TO THE UNIFORM TIRE QUALITY GRADING (UTQG) RULE

HSL 78-08

FOR TRACTION, EXCEPT AS OTHERWISE STIPULATED.

R. J. LAW ENGINEERS, INC., 23680 RESEARCH DRIVE,  
FARMINGTON HILLS, MICH. 48024

\$19,500.00

TO BE COMPLETED THREE (3) MONTHS FROM DATE  
OF CONTRACT AWARD (2 MAY 78).

DOT-HS-4-00946 MOD. 4

#### **A COMPARISON OF ALCOHOL INVOLVEMENT IN PEDESTRIANS AND PEDESTRIAN CASUALTIES**

A CONFERENCE OF EXPERTS SHALL BE ORGANIZED AND CONDUCTED FOR THE PURPOSE OF IDENTIFYING COUNTERMEASURE POSSIBILITIES FOR ALCOHOL-PEDESTRIAN ACCIDENTS (TASK 4 OF PHASE 2).

DUNLAP AND ASSOCIATES, ONE PARKLAND DRIVE,  
DARIEN, CONNECTICUT 06820

INCREASED \$14,410.00

NO CHANGE

DOT-HS-4-00955 MOD. 7

#### **EXPERIMENTAL FIELD TEST OF PROPOSED ANTI- DART-OUT TRAINING PROGRAMS**

THE FOLLOWING MODIFICATIONS ARE MADE TO THE CONTRACT: CONTRACTOR SHALL CONTINUE TO PROVIDE SAFE STORAGE FOR PROGRAM TRAINING MATERIALS, PROVIDE ADDITIONAL BRIEFINGS IN WASHINGTON, D.C. FOR TRAFFIC SAFETY PROGRAMS PERSONNEL COVERING THE RESULTS OF THE FIELD TESTING AND IMPLEMENTATION OF THE PROGRAM, PRODUCE A PILOT/RESEARCH VERSION (EITHER VIDEOTAPE OR FILM) OF AN INTRODUCTORY TRAINING AID TO BE USED IN ACQUAINTING DADE COUNTY SCHOOL SYSTEM PERSONNEL WITH THE FEATURES OF THE ANTI-DART-OUT TRAINING PROGRAM, AND DEVELOP FORMAL TRAINING MATERIALS AS NEEDED TO PROVIDE TRAINING FOR THE POSITIONS OF PROGRAM COORDINATOR AND INSTRUCTOR AS CONCEIVED WITHIN THE CONTEXT OF THE ANTI-DART-OUT TRAINING PROGRAM. 0 AN

APPLIED SCIENCE ASSOCIATES, INC., BOX 158,  
VALENCIA, BUTLER COUNTY, PA 16059

INCREASED \$19,420.00

EXTENDED TO 31 JUL 78

DOT-HS-5-01063 TASK ORDER 13

#### **CASE STATISTICAL ANALYSIS**

A COMPLETE DATA FILE AND A SERIES OF TABLES ON TIRE FAILURE CASES FOR FIRESTONE STEEL-BELTED RADIAL TIRES SHALL BE PRODUCED FOR THE NATIONAL HIGHWAY TRAFFIC SAFETY AD-

August 31, 1978

MINISTRATION'S (NHTSA) OFFICE OF DEFECTS INVESTIGATION (ODI). 0 IN

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

\$37,926.00

TO BE COMPLETED BY 31 JUL 78.

DOT-HS-5-01063 TASK ORDER 14

### SEAT BELT QUESTIONNAIRE SURVEY

APPROXIMATELY 50 QUESTIONNAIRES OBTAINED IN THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S (NHTSA) SEAT BELT QUESTIONNAIRE SURVEY SHALL BE REVIEWED IN ORDER TO DEVELOP CODES FOR ALL DATA AND FOR EXPLANATIONS TO THOSE ITEMS IN WHICH A PROBLEM HAS BEEN ENCOUNTERED. DATA FROM ALL QUESTIONNAIRES WILL BE CODED AND KEYPUNCHED TO PROVIDE A COMPLETE FILE, AND A MAXIMUM OF FIVE (5) STATISTICAL TABLES SHALL BE PREPARED. OROV

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

\$3,260.00

TO BE COMPLETED BY 31 MAY 78.

DOT-HS-5-01132 IA MOD. 6

### HEAD MODEL INJURY CRITERIA DEVELOPMENT

IN THE DEVELOPMENT AND VALIDATION OF FINITE-ELEMENT HEAD MODELS OF THE HUMAN AND PRIMATE FOR USE IN DERIVING HUMAN HEAD INJURY CRITERIA FOR UPGRADING THE FMVSS NO. 400 SERIES, THE FOLLOWING WORK SHALL BE CONDUCTED: WITH RESPECT TO MODEL IMPROVEMENT AND EXTENSIONS, CORRECT THE DELAYED DYNAMIC SHEAR RESPONSES FOR NEARLY INCOMPRESSIBLE MATERIAL AND BROADEN THE MODEL APPLICABILITY TO INCLUDE SIDE IMPACT SIMULATIONS AS WELL AS IMPROVE THE EFFICIENCY AND ACCURACY OF THE MODELS; PROCESS THE EXPERIMENTAL DATA (FROM THE BIOMECHANICS RESEARCH PROGRAMS OF THE MEDICAL SCHOOL OF THE UNIVERSITY OF CALIFORNIA AT SAN DIEGO (UCSD)) AND CONDUCT MODEL SIMULATIONS00 AN

CIVIL ENGINEERING LABORATORY, NAVAL CONSTRUCTION BATTALION CENTER, PORT HUENEME, CALIFORNIA 94043

INCREASED \$77,000.00

TO BE COMPLETED TWELVE (12) MONTHS FROM DATE OF MODIFICATION AWARD (9 JUN 78).

DOT-HS-6-01365 TASK ORDER 4

DOT-HS-5-01236 IA MOD. 6

### INVESTIGATION OF IMPACT BIODYNAMICS

THE INVESTIGATION OF HUMAN, ANIMAL, AND DUMMY SUBJECTS UNDER IMPACT LOADING SHALL BE EXTENDED TO INCLUDE A FURTHER INVESTIGATION WHICH WILL INVOLVE INERTIAL TRANSDUCERS AS SENSING ELEMENTS TO MEASURE BODY PART MOTIONS UNDER IMPACT LOADING.

WRIGHT-PATTERSON AIR FORCE BASE, AEROSPACE MEDICAL RESEARCH LABORATORY, WRIGHT-PATTERSON AFB, OHIO 45433

INCREASED \$133,111.00

TO BE COMPLETED ONE (1) YEAR FROM DATE OF MODIFICATION AWARD (15 MAY 78).

DOT-HS-5-01243 MOD. 5

### TRAFFIC SAFETY PROGRAM MANAGEMENT FELLOWSHIP AND INTERNSHIP-MODEL PROGRAM DEVELOPMENT

AN ADDITIONAL 12 FELLOWSHIP/INTERNSHIPS IN THE AMOUNT OF \$6,000 EACH SHALL BE AWARDED TO STUDENTS QUALIFIED FOR GRADUATE ADMISSION AND ACCEPTED FOR ENROLLMENT IN THE UNIVERSITY OF SOUTHERN CALIFORNIA'S (USC) MASTER'S DEGREE SPECIALIZATION IN TRAFFIC SAFETY PROGRAM MANAGEMENT WITHIN THE MASTER'S DEGREE IN PUBLIC ADMINISTRATION. OROV

DOT-HS-6-01365 TASK ORDER 4

### MULTIVARIATE MODELING AND ANALYSIS: THORACIC INJURY CRITERIA

USING THE TECHNIQUES AND PROCEDURES DEVELOPED UNDER TASK ORDER NO. 2, ALL NEWLY AVAILABLE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) THORACIC IMPACT DATA SHALL BE PROCESSED AND INTRODUCED TO A COMMON DATA POOL; THE CAPABILITY OF THE PRESENT THORACIC INJURY FUNCTIONS TO PREDICT INJURIES OBSERVED IN THESE NEW EXPERIMENTS SHALL BE ASSESSED AND NEW FUNCTIONS REGENERATED IF THE PERFORMANCE IS FOUND TO BE POOR.INC

ADAPTRONICS, INC., WESTGATE RESEARCH PARK, 7700 OLD SPRINGHOUSE ROAD, MCLEAN, VIRGINIA 22101

\$53,930.00

TO BE COMPLETED BY 15 MAY 79.

DOT-HS-6-01478 MOD. 12

**STANDARD ENFORCEMENT TESTING PROGRAM  
TESTING OF PASSENGER VEHICLES FOR  
COMPLIANCE WITH FMVSS NOS. 219 AND 301-75**

THE TOTAL NUMBER OF VEHICLES TO BE TESTED UNDER DELIVERY ORDER NO. 11 FOR TASK 1 PARAGRAPH B AND TASKS 2, 3, AND 4 IS INCREASED BY 10, FROM 35 TO 45. 0L B

DYNAMIC SCIENCE, INC., 1850 WEST PINNACLE PEAK ROAD, PHOENIX, ARIZONA 85027  
INCREASED \$2,700.00  
NO CHANGE

DOT-HS-6-01429 MOD. 2

**IMPACT OF MOTORCYCLE USAGE IN COLORADO**

STATISTICAL ANALYSES SHALL BE CONDUCTED WHICH WILL BE ORIENTED TOWARD DETERMINING THE RELATIONSHIP BETWEEN THE MOTORCYCLE ACCIDENT INJURY SEVERITY AND THE USAGE OF THE MOTORCYCLE HELMET (TASK 5 MODIFICATION). THIS STUDY SHALL INCLUDE CONSIDERATION OF THE FOLLOWING ASPECTS OF THE RELATIONSHIP: THE EFFECT OF THE HELMET LAW REPEAL ON THE USAGE OF MOTORCYCLE HELMETS IN THE STATE; THE FREQUENCY AND SEVERITY OF THE INJURIES SUFFERED WITH AND WITHOUT HELMETS; THE DISTRIBUTION OF FATAL INJURIES BY BODY AREA WITH AND WITHOUT HELMETS; AND THE EFFECTIVENESS OF THE HELMET IN REDUCING THE NUMBER AND/OR SEVERITY OF HEAD INJURIES.

STATE OF COLORADO, DEPARTMENT OF HIGHWAYS, DIVISION OF HIGHWAY SAFETY, 4201 EAST ARKANSAS AVENUE, DENVER, COLORADO 80222  
INCREASED \$12,400.00  
EXTENDED TO 30 APR 78

DOT-HS-6-01424 MOD. 2

**DESIGN AND EVALUATION OF HIGHWAY SAFETY  
P.I. AND E. PROGRAMS**

IN CONJUNCTION WITH THE PROJECT TO EVALUATE AND PROVIDE TECHNICAL ASSISTANCE IN THE DESIGN OF STATE HIGHWAY SAFETY PUBLIC INFORMATION AND EDUCATION PROGRAMS AS PART OF THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S (NHTSA) NATIONAL PUBLIC INFORMATION AND EDUCATION (P.I. AND E.) PROGRAM, THE FOLLOWING REVISIONS IN THE WORK TO BE PERFORMED ARE MADE: DELETE TASK 3 (CONDUCT NATIONAL SURVEY) OF PHASE 1; AND FOR TASKS 1-4 OF PHASE 2, SUBSTITUTE THE FOLLOWING TASKS: CONTINUE TO REVIEW ALL MEDIA MATERIALS, RESEARCH AND EVALUATION STUDIES AND OTHER LITERATURE PERTINENT TO THE NATIONAL AND LOCAL P.I. AND E. PROGRAM ACTIVITIES (TASK 1); REVISE THE METHODOLOGY AND PLAN AS NECESSARY FOR A FOLLOW-UP NATIONAL TELEPHONE SURVEY (TASK 2); CONDUCT A NATIONAL TELEPHONE SURVEY TO DETERMINE WHETHER

ANY CHANGES IN PRIORITY SAFE DRIVING BEHAVIORS, KNOWLEDGE AND ATTITUDES REPORTED BY THE PUBLIC ARE RELATED TO PUBLIC EXPOSURE TO THE NHTSA P.I. AND E. PROGRAMS (TASK 3); IN COOPERATION WITH THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, CONDUCT A STUDY TO VALIDATE THE "YOUTH'S SELF-TEST ON ALCOHOL AND SAFETY" USING A REPRESENTATIVE SAMPLE OF HIGH SCHOOL STUDENTS (TASK 4); PROVIDE TECHNICAL ASSISTANCE AND SUPPORT TO STATE AGENCIES ON THE "55 MPH SPEED LIMIT" CAMPAIGNS AND THIS PUBLIC INFORMATION AND EDUCATION PROGRAM (TASK 5); AND PROVIDE TECHNICAL ASSISTANCE AND CONSULTANT TIME TO NHTSA PERSONNEL ON "55" AND OTHER HIGHWAY SAFETY ISSUES AND PROGRAMS (TASK 6). 0ED

APPLIED RESEARCH DIVISION, TEKNEKRON, INC., 4701 SANGAMORE ROAD, WASHINGTON, D.C. 20016  
INCREASED \$28,932.00  
NO CHANGE

DOT-HS-7-01635 MOD. 2

**FIELD TEST OF A MOTORCYCLE SAFETY  
EDUCATION COURSE FOR NOVICE DRIVERS**

THE FOLLOWING TASKS SHALL BE ADDED TO PHASE 3: DURING THE SPRING AND SUMMER OF 1978, AT LEAST 20 SECTIONS OF THE COURSE, WITH 12 STUDENTS IN EACH, SHALL BE CONDUCTED FOR THE PURPOSE OF EVALUATING COURSE REVISIONS, EVALUATING THE COURSE CONDUCTED WITH AND WITHOUT STREET LESSONS, AND DETERMINING THE ENROLLMENT POTENTIAL OF SELECTED HIGH SCHOOLS IN JEFFERSON COUNTY; DATA AVAILABLE FROM THE JEFFERSON COUNTY PUBLIC SCHOOLS AND FROM APPROPRIATE POLICE AND LICENSING AUTHORITIES SHALL BE ANALYZED IN ORDER TO DETERMINE THE PROPORTION OF COURSE GRADUATES WHO OBTAIN A MOTORCYCLE LICENSE WITHIN SIX MONTHS OF COURSE COMPLETION, THE AMOUNT OF STREET RIDING PERFORMED BY GRADUATES IN THE PERIOD AFTER COURSE COMPLETION (UP TO 12 MONTHS), AND THE LEVEL OF STUDENT ACCIDENT INVOLVEMENT IN THE PERIOD AFTER COURSE COMPLETION (UP TO 12 MONTHS); AND ANALYZE THE FEASIBILITY OF DETERMINING WHETHER OFFERING A BEGINNING RIDER COURSE TO 16-18-YEAR-OLDS AS PART OF THE REGULAR HIGH SCHOOL CURRICULUM INCREASES THE NUMBER OF STUDENTS WHO BUY AND RIDE MOTORCYCLES BEYOND WHAT THERE WOULD HAVE BEEN IF TRAINING WERE NOT OFFERED, AND IF FOUND FEASIBLE, THE ADVANTAGES AND DISADVANTAGES OF VARIOUS CANDIDATE APPROACHES SHALL BE DOCUMENTED WITH FORMULATION OF A PLAN FOR OBTAINING THE DATA THAT WOULD BE NECESSARY TO TEST THE HYPOTHESIS THAT OFFERING A COURSE DOES NOT SIGNIFICANTLY INCREASE THE

August 31, 1978

DOT-HS-8-01948

OVERALL AMOUNT OF EXPOSURE TO MOTORCYCLE  
ACCIDENT RISK AMONG 16-18-YEAR-OLDS.0).

APPLIED SCIENCE ASSOCIATES, INC., BOX 158,  
VALENCIA, PENNSYLVANIA 16059  
INCREASED \$49,538.00  
EXTENDED TO 15 NOV 78.

DOT-HS-7-01691 MOD. 3

#### **SUPPORT FOR ANALYTICAL TOOLS FOR AUTOMOTIVE FUEL ECONOMY ACTIVITIES**

ADDITIONAL DATA PROCESSING AND ANALYTICAL  
SUPPORT SHALL BE PROVIDED TO THE NATIONAL  
HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
(NHTSA) AUTOMOTIVE FUEL ECONOMY ACTIVITIES  
AS FOLLOWS: DETERMINATION OF THE NUMBER OF  
VEHICLE MILES TRAVELED (VMT) AS A FUNCTION  
OF VEHICLE AGE FOR VARIOUS GEOGRAPHICAL RE-  
GIONS THROUGHOUT THE UNITED STATES;  
ESTABLISHMENT AND IMPLEMENTATION OF A DATA  
BASE MANAGEMENT SYSTEM TO FACILITATE EN-  
FORCEMENT OF AUTOMOBILE DEALER COM-  
PLIANCE WITH REGULATIONS REQUIRING DISPLAY  
AND AVAILABILITY OF FUEL ECONOMY INFORMATI-  
ON FOR THE CONSUMER; AND ADDITIONAL EF-  
FORT IN PROVIDING SOLUTIONS TO VARIOUS QUICK  
REACTION RESPONSE ANALYTICAL/STATISTICAL  
PROBLEMS AND IN MAKING MODIFICATIONS TO  
EXISTING NHTSA PROGRAMS.

"THIS CONTRACT IS AWARDED BY THE SMALL  
BUSINESS ADMINISTRATION UNDER THE  
AUTHORITY OF SECTION 8(A) OF THE SMALL  
BUSINESS ACT (USC 637A), AND WILL BE  
ADMINISTERED BY THE DEPARTMENT OF  
TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC  
SAFETY ADMINISTRATION."  
INCREASED \$74,778.00  
EXTENDED TO 31 DEC 78.

DOT-HS-7-01781 MOD. 1

#### **CONSUMER BEHAVIOR TOWARDS FUEL EFFICIENT VEHICLES**

UTILIZING THE NECESSARY DATA ELEMENTS AL-  
READY COLLECTED AND MAINTAINED IN ITS  
PROPRIETARY DATA BANK, THE CONTRACTOR  
SHALL CONDUCT AN ANALYSIS TO PROVIDE THE  
AVERAGE ANNUAL VEHICLE MILES TRAVELED  
(VMT) BY VEHICLE AGE AND VEHICLE TYPE. THE  
ANALYSIS SHALL ALSO PROVIDE THE SAMPLE SIZE  
FOR EACH CATEGORY OF AVERAGE ANNUAL VMT,  
AS WELL AS THE ASSOCIATED STANDARD DEVIAT-  
ION. 0D (

MARKET FACTS, INC., 1750 K STREET, NO. 1240,  
WASHINGTON, D.C. 20006  
INCREASED \$23,692.00  
TO BE COMPLETED SIXTY (60) DAYS FROM DATE OF  
MODIFICATION AWARD (5 JUN 78).

DOT-HS-8-01857

#### **USAGE OF THE HSRI ACCIDENT SYSTEM**

THE HIGHWAY SAFETY RESEARCH INSTITUTE (HSRI)  
OF THE UNIVERSITY OF MICHIGAN WILL CONTINUE  
TO PROVIDE ASSISTANCE IN THE USE OF ITS AC-  
CIDENT DATA SYSTEM TO THE NATIONAL HIGHWAY  
TRAFFIC SAFETY ADMINISTRATION (NHTSA) AS FOL-  
LOWS: MAINTAIN THE COMPUTER PROGRAMS, TER-  
MINAL ACCESS PROGRAMS AND HSRI FILE SYSTEM  
SO THAT THE DATA BASES CAN BE ACCESSED BY  
NHTSA; PROVIDE CONSULTING SERVICES TO SOLVE  
ANY PROBLEMS THAT MAY ARISE IN THE USE OF  
THE REMOTE TERMINAL AND PROCESSING OF THE  
DATA BASES; PERFORM CERTAIN SELECTED DATA  
MANIPULATIONS; PROVIDE FORMAL TRAINING SES-  
SIONS IN SYSTEM USAGE; AND PROVIDE DOCUMEN-  
TATION FOR USE OF THE DATA FILES AND PRO-  
GRAMS. 0D A

THE REGENTS OF THE UNIVERSITY OF MICHIGAN,  
260 RESEARCH ADMINISTRATION BUILDING, THE  
UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN  
48105  
\$25,025.00  
1 OCT 76 THROUGH 30 SEP 77

DOT-HS-8-01948

THE NATIONAL ACADEMY OF SCIENCES  
SHALL CONVENE A COMMITTEE OF  
SCIENTISTS UNDER ITS  
CURRENT NATIONAL  
ADMINISTRATION  
ANTHROPOMORPHIC  
RESPECT TO NHTSA'S CURRENT AND FUTURE  
TEXT OF NHTSA'S LEGAL AND ENGINEERING  
PREROGATIVES AND RESPONSIBILITIES. THE COM-  
MITTEE SHALL ASSESS THE ABILITY OF THIS PRO-  
GRAM TO ACHIEVE NHTSA'S STATED GOALS, EVAL-  
UATE THE UTILITY OF CADAVER TESTING OR  
OTHER MAJOR TESTING MODES ON THE QUALITY  
AND TIMELINESS OF ACHIEVING THESE GOALS,  
AND RECOMMEND ANY ALTERNATIVE APPROACHES  
CONSIDERED CAPABLE OF PRODUCING FEASIBLE,  
TIMELY AND PRACTICABLE SOLUTIONS TO THE  
PROBLEM OF ANTHROPOMORPHIC DUMMY  
DEVELOPMENT. QUI

NATIONAL ACADEMY OF SCIENCES, 2101  
CONSTITUTION AVENUE, N.W., WASHINGTON, D.C.  
20418  
\$39,700.00  
TO BE COMPLETED SEVENTY-FIVE (75) DAYS FROM  
DATE OF CONTRACT AWARD (31 MAY 78).

# **ANALYSIS OF FARS DATA AND PRODUCTION OF FARS REPORT**

DATA IN THE FARS (FATAL ACCIDENT REPORTING SYSTEM) DATA BASE SHALL BE TABULATED AND ANALYZED AND A 1977 FARS ANNUAL REPORT IN THE FORM OF STATISTICAL HIGHLIGHTS FOR THE YEAR SHALL BE PRODUCED.

"THIS CONTRACT IS AWARDED BY THE SMALL BUSINESS ADMINISTRATION UNDER THE AUTHORITY OF SECTION 8(A) OF THE SMALL BUSINESS ACT (USC 637A), AND WILL BE ADMINISTERED BY THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

\$44,974.00

TO BE COMPLETED FOURTEEN (14) WEEKS FROM DATE OF CONTRACT AWARD (12 MAY 78).

DOT-HS-8-01956

# **COMPLIANCE TESTING OF PASSENGER VEHICLES IN ACCORDANCE WITH FMVSS NO. 216 "ROOF CRUSH RESISTANCE"**

PASSENGER CARS SHALL BE TESTED IN ACCORDANCE WITH FMVSS NO. 216, ROOF CRUSH RESISTANCE, FOLLOWING THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S (NHTSA) OFFICE OF STANDARDS ENFORCEMENT (OSE) LABORATORY TEST PROCEDURE TP-216-01 DATED NOVEMBER 11, 1977.CAL

SOUTHWEST RESEARCH, INC., 6220 CULEBRA ROAD,  
P.O. DRAWER 29516, SAN ANTONIO, TX 78284

PER DELIVERY ORDER

TO BE COMPLETED ONE (1) YEAR FROM DATE OF CONTRACT AWARD (22 MAY 78).

DOT-HS-8-01958

# **COMPLIANCE TESTING OF PASSENGER VEHICLES IN ACCORDANCE WITH FMVSS NO. 216 "ROOF CRUSH RESISTANCE"**

PASSENGER CARS SHALL BE TESTED IN ACCORDANCE WITH FMVSS NO. 216, ROOF CRUSH RESISTANCE, FOLLOWING THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S (NHTSA) OFFICE OF STANDARDS ENFORCEMENT (OSE) LABORATORY TEST PROCEDURE TP-216-01 DATED NOVEMBER 11, 1977.

APPROVED ENGINEERING TEST LABS., 1536 EAST VALENCIA DRIVE, P.O. BOX 4158, FULLERTON, CA 92631 (ORANGE COUNTY)

PER DELIVERY ORDER

TO BE COMPLETED ONE (1) YEAR FROM DATE OF CONTRACT AWARD (22 MAY 78).

# **50TH PERCENTILE MALE ANTHROPOMORPHIC DUMMIES**

THREE (3) 50TH PERCENTILE MALE ANTHROPOMORPHIC DUMMIES (IN ACCORDANCE WITH PART 572 OF FMVSS NO. 208 DATED SEPTEMBER 1, 1973) SHALL BE PROVIDED. THE QUALITY CONTROL ON THESE DUMMIES MUST BE CERTIFIABLE PER FMVSS NO. 208. THE DUMMIES SHOULD BE SHIPPED BY AIR IF POSSIBLE, IF NOT, THEN BY EXPRESS TRUCK.

HUMANOID SYSTEMS, 747 E. 223RD STREET, CARSON, CALIFORNIA 90745

\$19,500.00

TO BE COMPLETED THIRTY (30) DAYS FROM DATE OF DELIVERY ORDER AWARD.

U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY  
ADMINISTRATION  
Washington, D.C. 20590

Official Business

PENALTY FOR PRIVATE USE, \$300

POSTAGE AND FEES PAID  
NATIONAL HIGHWAY TRAFFIC  
SAFETY ADMINISTRATION  
DOT 517



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